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Castings Give Artistic Touch To Lunch Rooms

REMARKABLE changes have taken place in restaurants and lunch rooms during the past 20 years. The old time counter with its white wood top, and the uncomfortable four leg stools have been replaced with attractive furnishings designed to please the eye and at the same time permit maximum efficiency in serving customers. Owners and managers of restaurants, lunch rooms, and coffee shops are aware of the fact that beautiful appointed interiors for any type of restaurant will help greatly to increase patronage. The luxurious surroundings often are featured in the advertisements of the establishment. The management of a large metropolitan hotel, in speaking of its lunch room, says "There is a serpentine counter winding the length of the room, its dark marble top gleaming under the lights of the quaint lighting fixtures. There are stools of solid bronze around the counter with the artistic crest of the hotel embossed upon the stool backs." Many modern lunch rooms have installed stools constructed almost entirely of castings. Strength is secured with pedestals built of casting. Cast backs provide a wide latitude in the selection of pleasing designs and at the same time give sufficient strength to withstand constant use by the patrons of the establishment.

Castings Are Used in the Construction of Stools Installed in the Lunch Room of a Large Midwestern Hotel

Find Where Castings Can Be Sold

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OPERATES MODERN FOUNDRY
Old French Town

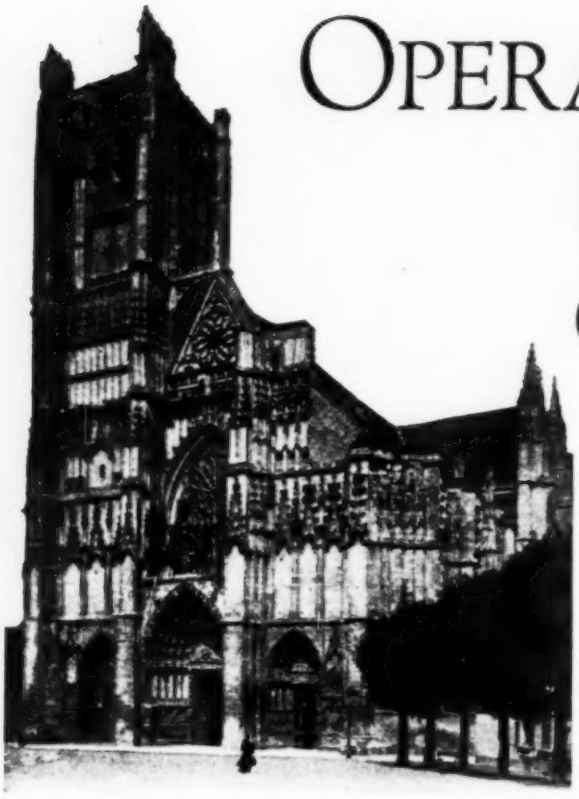


Fig. 1—The cathedral at Auxerre, began in 1215 and finished in the sixteenth century

MORE than 80 years ago a small factory for the assembling of woodworking machinery was founded at Auxerre, a comparatively small and quiet French town, about 100 miles southeast of Paris. Through the foresight and initiative of three successive generations, the business gradually expanded until the firm has become one of the leading manufacturers of woodworking machinery of the world, and operates one of the most important foundries in France. The position of repute now enjoyed by the firm is entirely due to the determination of its leaders to keep abreast of modern developments in plant equipment, and to their faculty of concentrating their efforts on the making of a product of high quality. The business, a private company established in 1847, is controlled by the grandson of the founder. As the works developed, every improvement found worth while has been adopted. Before a new machine is put on the market, each component part is studied in detail. Once the design is accepted, the parts are turned out to make up the machine only after having been subjected to severe tests in the plant.

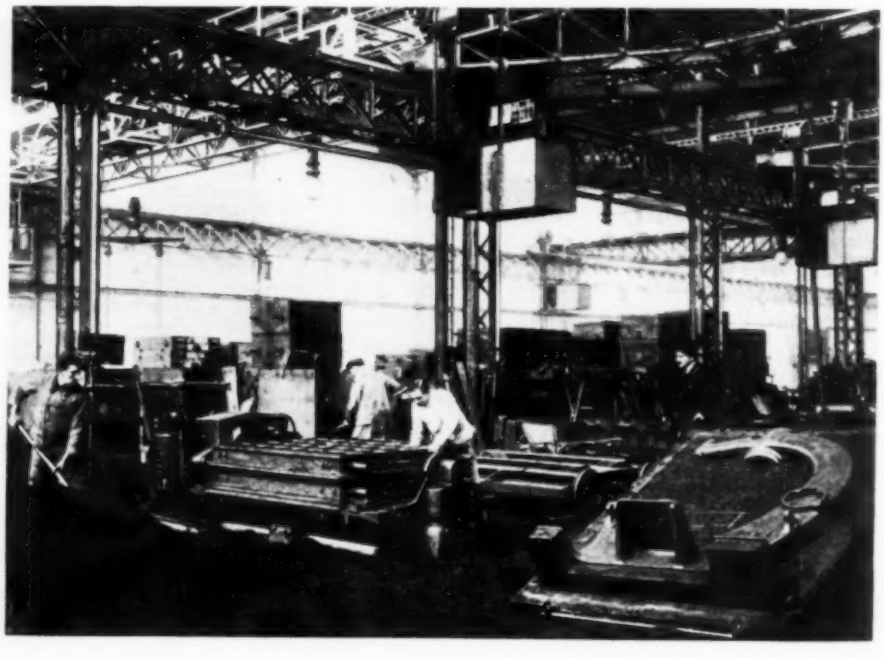


Fig. 2—Band saw frames and other comparatively large castings are made at this station

The foundry, described in this article, is cited in France as a model of its kind. Development of an adequate personnel was one of the difficulties that had to be solved as the plant grew in importance. Auxerre is not an industrial town. It is an old city of medieval character, situated in an agricultural district, and the plant of Guilliet Fils is practically the only one existing in the region. The founder did not wish to import labor from other districts and thus modify the character of the town and its surroundings. This policy has been maintained by his successors. Consequently, the workmen employed at the Guilliet plant are drawn mostly from the native population. The skilled hands have been trained in the works.

Keep Shops Clean

Gradual development of the business and increasing demand for the type of woodworking machines made at the works necessitated the introduction of some means to increase production. In view of the desire of the management not to augment the number of workmen by importing labor, recourse was taken early to mechanical equipment and methods. In this particular case

By
Vincent Delport
European Manager, The Foundry

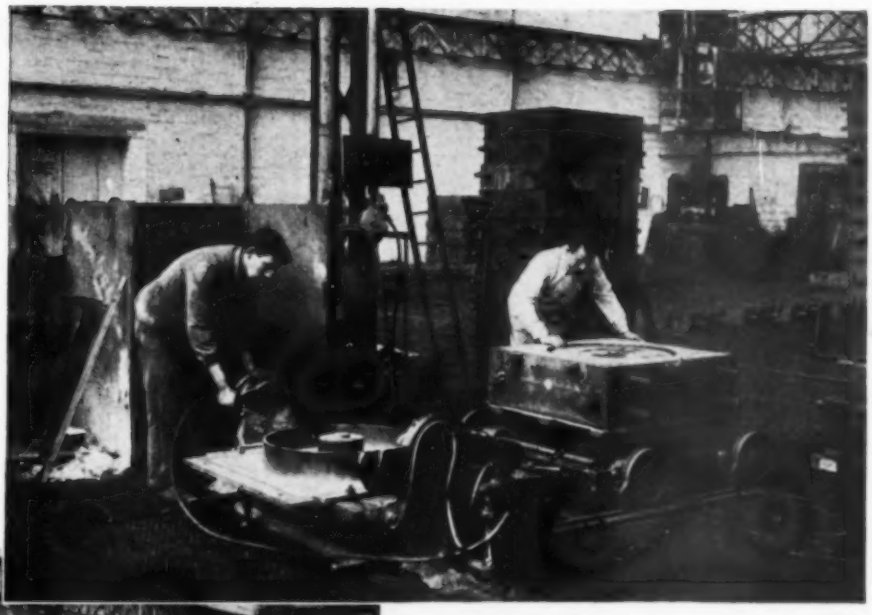
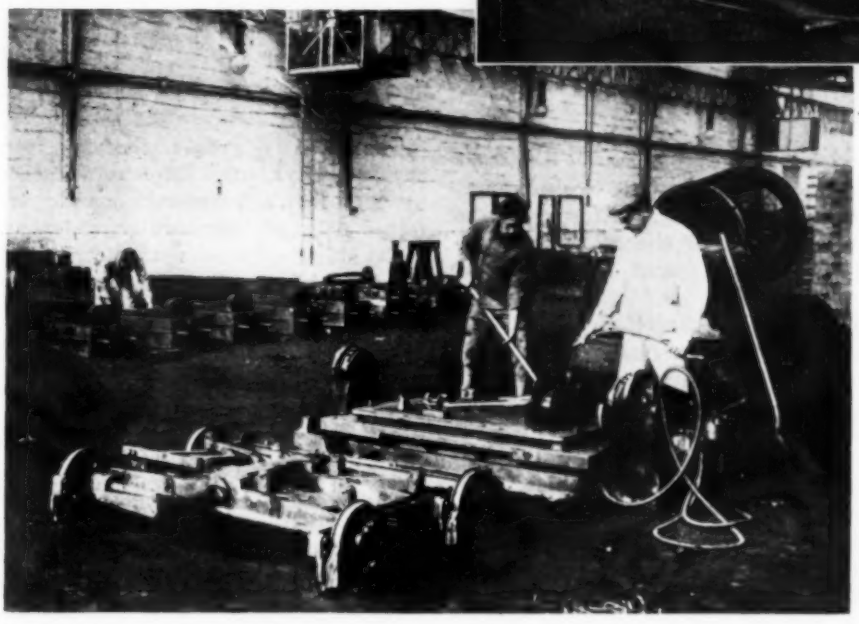


Fig. 3 (Below)—Molds made from a split pattern are lifted by the crane and assembled across the gangway. Fig. 4 (Right)—Flasks may be built to any height by bolting sections together



the object in installing machinery was not primarily to reduce production costs, but to economize labor and at the same time increase production. However, all the other advantages of using machinery are appreciated fully by the owner.

The visitor to the plant is impressed by the fact that the leading principle throughout the whole plant is absolute order and cleanliness. This principle is followed right down to the minutest details. Machines are placed in strict alignment, racks and benches are provided everywhere for tools and implements, the concrete alleys for the passage of trucks are swept at regular intervals. The shops are whitewashed every two or three years. It has been found that this discipline increases efficiency. The workmen accept it and as a result work under pleasant and healthy conditions.

Up to 1923 only a few hand and hydraulic molding machines were used in the foundry. In 1923, M. Guilliet decided to make all the castings he required at the Auxerre foundry. He installed a rollover machine made by the Osborn Mfg. Co., Cleveland. This soon was followed by a second machine, and the results obtained were so satisfactory that it was decided to give up hand-molding entirely and to install machine-molding throughout the shop. This program was executed rapidly and by the close of 1924 a series of machines from the same source was fitted. These machines cover a complete range from the smallest machines to large jolt rollover pattern draw machines electrically operated. At the same time the pattern equipment was overhauled and brought in line with the new molding methods. All the castings now are made in green sand molds.

At present the company's catalog presents a variety of from 400 to 500 woodworking machines for which all the castings are machine-molded. Even for an order of three or four castings the molds are made on molding machines. The wood patterns are mounted on cast iron plates on both sides.

Metal Pattern Plates

Pattern plates in metal cast over cement also are used. The alloy employed for these pattern plates contains lead, 78 per cent, antimony, 18 per cent, and tin 4 per cent. These patterns used for machine-molding last much longer than those previously used for hand-molding and are easier to stock and classify. Less time is taken in the pattern shop for the purpose of mending deteriorated patterns or remaking them, and it now is possible to make a larger quantity of new patterns for new types of machinery. The company has been able to put on the market an entirely new range of woodworking machines, including large mass-production machines. This

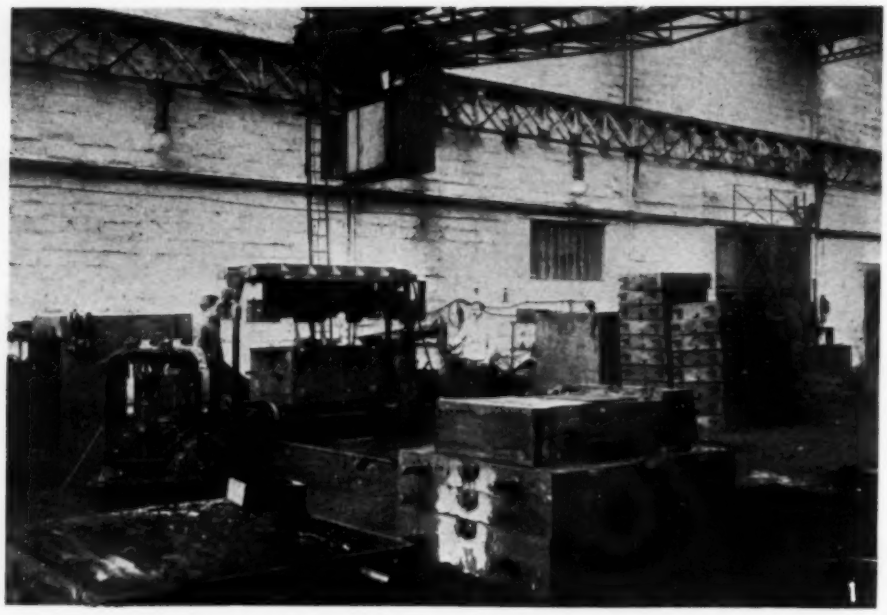


Fig. 5—Deep frames are made on a jolt rollover pattern draw machine

result has been obtained without increasing the number of patternmakers, while at the same time it is no longer necessary to order patterns from outside. All these improvements are entirely due to, and were made possible by, the installation of mechanical molding methods.

Part of an existing building was utilized for the foundry. The other part of the building is the assembling shop. All the bays in the building are identical in size. Disposition of the bays and location of the molding machines are shown on the accompanying plan. The pattern shop naturally is equipped with woodworking machinery manufactured at the plant.

Before machine-molding was adopted, more than half the work of the pattern shop was devoted to remaking and maintaining existing patterns. At present about 95 per cent of the time is given to making new patterns. The wood patterns can be used thousands of time. An occasional new coat of paint is all that is necessary.

Next to the section where the wooden patterns are made is another section where metal pattern plates and core boxes are prepared, and where the wood patterns are mounted on their cast iron plates. This section contains various machine tools for working metal, including several Guilliet drilling machines. Some of the firm's own woodworking machines also are used, including a band saw for cutting aluminum and pattern metal, a planing machine to plane the plaster patterns used to make aluminum core boxes, a polishing and a buffing machine to finish the pattern plates, the metal core boxes, etc.

Patterns, when not in use, are stocked in a separate building, about 1½ miles from the foundry. The patterns are carried to and fro on the firm's own motor lorries. The building in which the patterns are stocked methodically is located on extensive grounds owned by the concern and where an entirely new foundry may be erected at some future time.

The same bay where the patterns are made also contains the foundry repair shop, two 100-horsepower compressors made by the Ingersoll-Rand Co., New York, two semi-automatic Baillot sand mills arranged to receive the sand from trucks which travel on rails on a line extending throughout the width of the foundry and across its center. The sand, after having been tempered, is distributed into four hoppers served by overhead cranes.

The foundry proper occupies four adjacent bays, each 52 feet 6 inches by 395 feet. Transportation is effected by two standard-gage tracks, one extending across the center of all four bays, from the sand plant at one side to the cupolas at the other side. This track serves for the transportation on trucks of the liquid iron, sand and dried cores. The second track is at one end of the foundry and is used to take the castings to the cleaning station. Molds, core boxes and flasks are handled by overhead cranes. A compressed air tube with tap is fitted on every pillar of the foundry.

Molds for the bodies of mass-production machines and for tables and flat castings are made in the first bay. A concrete gangway 6 feet 7 inches wide extends through the axis

Fig. 6—Cores are made on two small jolt machines shown in the left background, while small molds are made on two jolt rollover, pattern draw machines shown at the right

of the bay so that the auto trucks can circulate freely. These trucks are used for many purposes including the distribution of cores and the collection of runners and risers that return to the cupolas. The gangway also facilitates the proper alignment of the molding stations. The molding machines are on one side of the alley. Sand is distributed to each station and put into standard boxes with a capacity of 70.5 cubic feet. Molds are assembled and poured on the other side of the gangway.

The bay is served by five rollover jolting machine made by the Osborn Mfg. Co., Cleveland. Lifting capacity of these machines ranges from 2200 to 7700 pounds. They are used for molding the bodies of vertical woodworking machines, combined surfacing and planing machines, band saw machines and metal drilling machines. One of the molding machines is used throughout the year for the bodies of band saw machines with flywheels of 500, 600, 700 and 800 millimeters, (19.68, 23.62, 27.55 inches), which are produced in considerable quantities.

These molds are made in special shaped flasks to simplify the work and eliminate the use of gaggers. Other castings are molded in rectangular flasks. The copes are made in flasks with movable bars profiled in accordance with the shape of the pattern and with empty spaces where sand is not needed. This economizes sand and reduces the weight of the mold.

The highest castings made in this bay are the bodies of combined surfacing and planing machines, for which the drag must give a molding clearance of 800 millimeters (31.5 inches). This body, like all the other machine-made castings produced in the works, is molded in green sand. The height of the complete casting is 5.57 feet.

Fig. 9—Storage yard, showing castings molded on machines

In the middle of the bay are the four chutes of the sand plant. The sand is distributed to the various stations by grab buckets with a capacity of 35.3 cubic feet. These grabs are hoisted by two overhead 2-ton cranes. Contents of two grabs fill one standard box at the molding stations.

In the second half of the bay are five hydraulic molding machines: Three made by Bonvillain et Ronceray and two by Baillot, Paris. These machines are used for the molds of tables for woodworking machines of normal dimensions. Another rollover Baillot machine is used for molding large tables in flasks 5.9 by 5.9 feet.

All these machines operate with a special bottom sand frame, constructed by the firm, in which the sand is squeezed. This frame, the same dimensions as the flask, is placed directly over the pattern plate, and the flask is placed on top of it. Thus an amount of sand is used in addition to that which normally would fill the flask. The pattern plate is pushed through the bottom sand frame until its base is flush with the lower part of the flask, and in this manner the sand is uniformly squeezed and the resulting mold is firm. It is proposed to install a second one of these machines for flasks 5.9 by 5.9 feet.

No. 2 bay is served by five 6-ton overhead cranes with a bridge speed of 328 feet a minute; carriage travel 32 feet per minute, lifting speed 32 feet a minute. The management claims it is a mistake to employ slow-traveling cranes in a foundry. A fast crane can be operated slowly when necessary, as for example where ex-

Fig. 7—Where the planers are assembled and inspected. Fig. 8—One of the four bays of the foundry

treme precision is required in closing the molds.

A concrete gangway, 6 feet 7 inches wide, divides the second bay into two parts. One-half of the bay is devoted to the molding of medium-size castings on machines made by the Osborn Mfg. Co., Cleveland, and by the Tabor Mfg. Co., Philadelphia. Five of the largest machines are served by one-ton swing cranes with a radius of 13 feet and provided with pneumatic hoists. The other machines are served by two 6-ton traveling cranes. Bandsaw flywheel molds are made on a special machine supplied by Hainholz.

Heavy castings and parts ordered only in small quantities are made in the other half of the bay on two machines made by the Osborn Mfg. Co., and in one British machine. One machine has a lifting capacity of 5 tons, and is used for molding heavy bandsaw machine frames, bases of log sawing machines and, in general, all castings that will go in flasks 5 feet 3 inches x 7 feet 3 inches. Two of the machines are of the plain jolt type and operate in combination with a pattern drawing device designed and made by Guilliet, Fils et Cie. All single castings, or those made in small quantities, are molded at this station. One of these machines takes molds up to 2.5 tons. The other machine takes molds up to 11 tons and can be used for molding the heaviest castings embodied in Guilliet machines, large 3-ton frames 13.12 feet long, for heavy-duty woodworking machines. All these molds are made in green sand. The station is served by two 15-ton overhead cranes. The complete bay contains four traveling cranes and four swing cranes.

The third bay is equipped with a group of eight jolt machines with flat tables for making large cores. Each pair of machines is served by a small air hoist. Small parts are molded on several rollover machines and on a number of hand molding machines. Sand for these machines is prepared in a plant including a riddle and a sand mill where the sand is tempered and where new sand is added. The sand is fed to the plant by shoveling.

In this bay one can see the only hand molder employed in the foundry. This unique craftsman makes spare parts for those machines used in the works for which there are no patterns, or for old-type woodworking machines for which the only existing patterns can be used for hand molding. This molder devotes his spare time to making cores or assembling molds.

On each side of the cupola room, which is in the adjoining bay, is a coke-fired core-drying oven. These ovens open into the bay just described. Since mechanical molding methods have been introduced, only one oven now is necessary. Drying is effected overnight. The heaviest cores weigh one ton.

Four cupolas in the middle of the fourth bay are operated alternately in pairs. One pair has a capacity of 8 tons per hour while the second pair melts 10 tons per hour. The average daily heat is about 30 tons with an average output of 25 tons of finished castings.

Raw materials, coke, flux, various grades of pig iron, and scrap, are stocked in a yard outside the foundry. The materials handled in bulk by carts and trucks are taken up to the charging platform by a vertical elevator. The platform is of sufficient size to hold a large stock of materials. It is there that the charges are weighed and made up. Charging is effected by hand.

The shake-out station and cleaning room on one side of the cupola room is separated from the rest of the foundry by a brick partition. The cleaning room is equipped with pneumatic tools. Outside the foundry is a shed containing four sandblast cabins. In two of these the operator works inside the cabin. The other two are operated from the outside, the castings being placed on platforms which travel in and out of the cabin over rails. Transportation of the

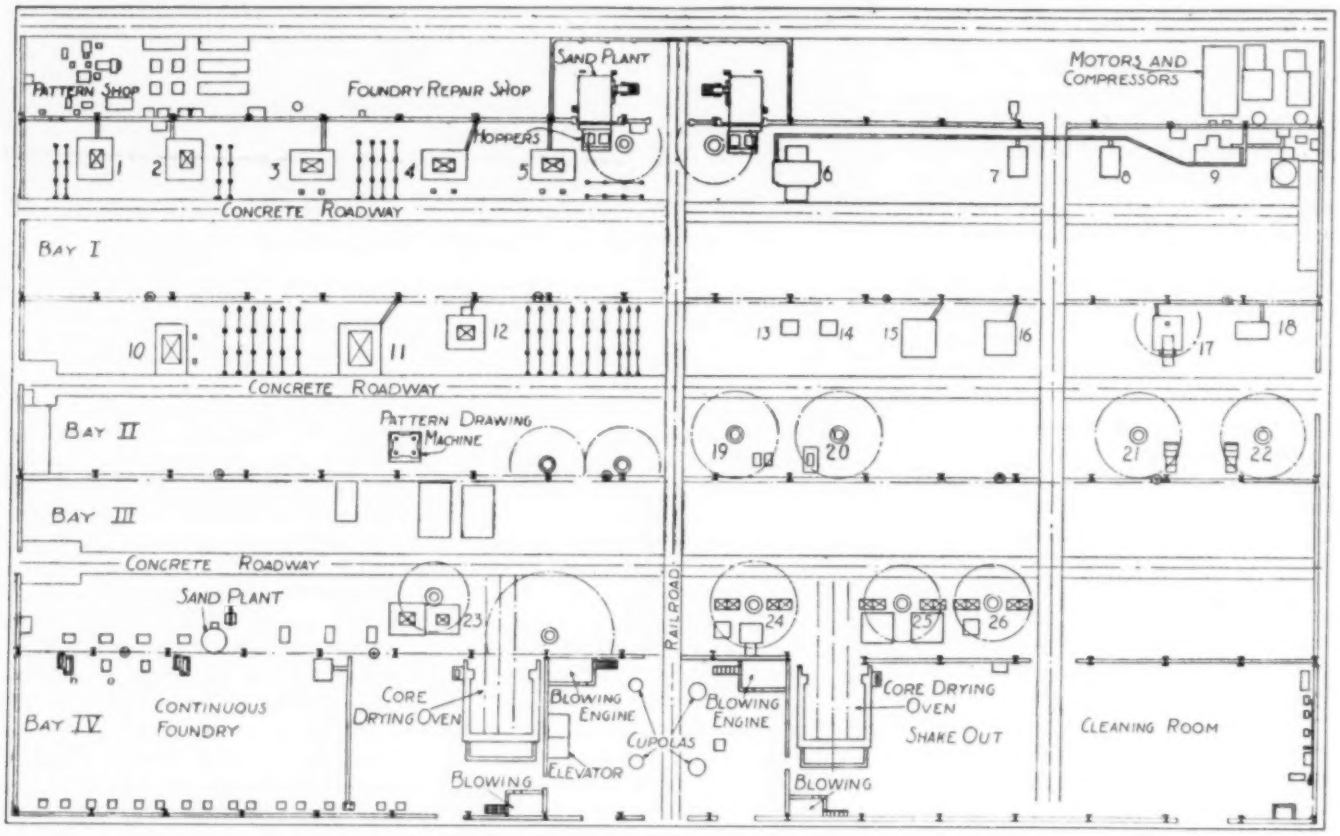


Fig. 10—General plan of the foundry showing the location of all the main features

castings from the foundry to the sandblast apparatus, and from there to the shipping department, is effected by electric trucks.

A continuous molding station is being installed on the other side of the cupolas, a space 49.2 x 164 feet. This will be equipped with 12 hydraulic molding machines and 12 small machines. Molds from two molding units will be carried on conveyors consisting of a chain driving a number of plates which slide directly on rails. Sand will be taken to the two units by a continuous steel belt. These units are expected to start operating in the second half of 1929. Diversity of size and weight of castings to be made in this new department, render this a decided innovation in France. Equipment and methods have been entirely conceived and planned by the engineers of the Guilliet firm.

Sand Handling

Sand handling in the foundry as it now exists is automatic. Behind each of the two sand plants are four bins made of steel plate which receive coal-dust, new molding sand which has been dried in a vertical dryer, and sand coming from the molding stations and from the shaking-out station. Vibrators are fitted to the bins to prevent the sand from sticking. The various components are mixed on a rubber belt which passes in front of the bins and which brings the mixture to an elevator which takes the sand up to the mills.

Before reaching the mills the sand passes over a magnetic separator and a riddle. Each sand mill, which has a capacity of 3 cubic meters (106 cubic feet) per hour, is operated by one man. After passing through the mills, the sand is taken up by elevators, passes through a separator and is stored in the four hoppers mentioned in describing the first bay of the foundry. Foreign materials that come from the sand mills are dumped into a large bin, under which passes an endless belt. One man sorts the foreign elements from the sand. Those that can be used again are sent back to the proper stations, and useless material is sent to the refuse heap. The sand which remains on the belt is itself sorted. The fine sand goes back to the sand hoppers at the molding machines, and the lumps are sent back to the sand mills. It has been found that this sorting economizes several cubic meters of new sand each day.

Poured molds are taken by an overhead crane and shaken out over grates placed over containers measuring 1 x 3 meters (3.3 x 9.8 feet). These containers later are lifted by the cranes and thus the sand is sent to the mills by lots of 3 cubic meters at a time. The man at the shaking-out station does not have to do any shoveling.

This process of handling sand in bulk also is used for large flasks. They are not filled from hoppers, but by large grab buckets measuring 1 x 1 x 1 meters (3.3 x 3.3 x 3.3 feet) brought to the flask by an overhead crane. It has been found that this system besides being economical accelerates the preparation of the molds. The same method is employed for all refuse and discards coming from the various stations. They are poured into 3 cubic meter buckets (106 cubic feet), placed in trenches. Above these buckets is a 6-ton electric traveling crane. These buckets are of the same capacity as the trucks which are used to carry the refuse away, and consequently a truck is filled in one operation.

The Guilliet foundry is designed primarily for mechanical operations. Since these mechanical improvements have been effected, the output of the foundry has been trebled. The output will be improved further by the addition of the conveying circuits with automatic distribution of the sand. Already the new system is being installed for the molding of small parts, and later it is intended to extend it to the larger molds. Improvements will be made in automatic charging of the cupolas, and also in cleaning of the castings. At present the firm produces about 10,000 machines per year, representing about 7000 tons of castings.

Book Review

Principles of Metallography—by Robert S. Williams and Victor O. Homerberg; second edition; cloth, 259 pages, 5½ x 8 inches; published by McGraw-Hill Book Co. Inc., and supplied by THE FOUNDRY, Cleveland, for $3, or in Europe by the Penton Publishing Co. Ltd., Caxton House, London, for 15s, net.

Originally written as a text for students of general science and engineering who do not specialize in metallography, the authors found it necessary to revise their work to keep pace with advances in this branch of science since the first edition was issued. Photomicrographs in the first edition have been replaced by photographs taken in the laboratories of the Massachusetts Institute of Technology. Both the authors are members of the teaching staff of that institution. A new chapter on the macroscopic examination of metals has been added to this new volume.

Gray Iron Institute Adds New Members

Gray Iron institute, Terminal Tower building, Cleveland, recently has elected the following foundries to membership in the organization: Riverside Foundry Corp., 1144 Military road, Buffalo; Buffalo Foundry & Machine Co., 1543 Filmore avenue, Buffalo; Mereen Johnson Machine Co., Minneapolis, Minn.; Canadian Mead-Morrison Co. Ltd., 317 South Main street, Welland, Ont., Can.; Topeka Foundry & Iron Works, 300 Jackson street, Topeka, Kans.; Sterrit-Thomas Foundry Co., Thirty-second and Smallman streets, Pittsburgh; Charles Parker Co., 48 Elm street, Meriden, Conn.; Jackson Street Foundry Inc., 52 Jackson street, Worcester, Mass.; Washburn Shops of Worcester Polytechnic institute, Boynton street, Worcester, Mass.; and Frederick Iron & Steel Co., Frederick, Md.

German Foundry Group Meets in Berlin

The Verein Deutscher Giessereifachleute held its nineteenth regular annual meeting in Berlin May 25 and 26. Previous to that meeting a session on electric furnaces was conducted by its committee on electric furnaces on May 24. Papers were presented at that session on quality of electric steel, the ironless induction furnace (high frequency), American electric furnaces and production of synthetic gray iron in the electric furnace. Authors of papers included K. von Kerpely, K. F. Krau, M. H. Kramer, and Dr. Mathesius.

The first session of the regular meeting was held in the great hall of the Engineers house on May 25. Papers at that session included "Development of a New Deoxidation and Melting Method for Metals, especially for Copper Alloys," by W. Reitmeister; "Development in Cast Iron Melting Processes and Charging Methods During the Past 50 Years," by Christ Gilles, and "Requirements of Men for Specialized Operations in the Foundry," by W. Stern.

In the second session which was held on May 26, E. Piwowarsky presented a paper on "How Is the Basic Steel Furnace to Be Evaluated Against the Acid Process?" This was followed by papers on training foundrymen as conducted by "Polytechnic Institutes and Mining Academies," by M. Paschke and in "Technical Colleges," by Dr. Geiger, Friedrich Dessauer presented a paper on "Technique and Efficiency."

Producing Steel Castings in the Modern Foundry

Part I

By Charles W. Veach

CHANGES which have been made in steel manufacture during the last quarter of a century have not been due to new principles discovered and applied to practices any more than they have to a better understanding of the old, and a more intelligent application of them to practices. Many changes have resulted from a better understanding of those principles which the founders of the processes recognized and on which according to their lights the various processes must function if a good product is expected.

For many years steel making processes proceeded according to tradition, similar to conditions prevailing in iron smelting and founding for centuries. However, chemistry began to play a part in steelmaking when it was still in its infancy. Under the influence of a growing knowledge of chemistry and the feeble efforts to apply the principles as soon as discovered in a more and more intelligent manner, tradition at last began to give way to science, bringing the dawn of the present era.

The transition period during which steel manufacture has evolved from rule-of-thumb practice to more nearly scientific practices had its inception during the life of many still engaged in the field today. Some of these men have been untiring students of metallurgy, and it is due partly to them that such great progress has been made. Their work established a firm foundation on which the younger generation may build. The author has passed through the fire of the old period but fortunately was not scorched by the inefficient methods of the past. He believes that he was one of the first to recognize the value of applying the principles of metallurgy according to their known relation in attaining high quality and production. While the value of a vivid imagination is emphasized, a natural bent for study and an inquiring mind also are important. Any one possessing these attributes will find metallurgy an interesting study.

No one can understand what takes place in metallurgical processes without first acquiring a knowledge of the physical chemistry involved. The part each element plays in refining processes must be known. Knowledge must be had on how one element is attracted to another and the result of their union. It is important to know the heats of formation of the various elements which enter largely in the actions which take place so that the energy liberated or consumed may be evaluated.

It is important to know the difference between exothermic and endothermic reactions, and just as im-

Describes Methods

IMPROVEMENT of quality and reduction of costs are paramount issues in the foundry industry today. This applies to other branches of the industry as well as to the steel castings foundry. Extreme watchfulness in molding, melting and costs, and adoption or adaptations of modern methods of production will assist in attaining the first mentioned requisites. Comparison of methods and ideas also is valuable and to this end the author has prepared a series of articles of which this is the first, dealing with modern steel castings production. Mr. Veach has been engaged in the steel foundry industry for the past 24 years.

FIG. 1—VIEW OF MOLDING BAY SERVED BY A 25-TON OPEN-HEARTH FURNACE AND A 3-TON ELECTRIC FURNACE. THE ELECTRIC FURNACE IS JUST BEYOND THE OPEN HEARTH

portant, to be able to distinguish between them by observing the actions in the bath. When two elements unite to form a compound, heat either is liberated or absorbed. This adds to or subtracts heat from the bath, While these principles are understood and applied by practical men more or less intelligently, their knowledge is the result of observing effects rather than reasoning from causes. This will be brought out clearly in some of the later articles on furnace practices.

The meaning of chemical affinity and the affinity of the various elements, called impurities, for iron and for each other in processes should be known. We should know that silicon is greedy for oxygen at about the melting temperature of iron while the avidity with which carbon unites with oxygen increases directly as the temperature rises. Manganese also unites with oxygen much more readily than does carbon. Phosphorus is oxidized as soon as the metal with which it is combined as iron phosphide becomes melted, and assumes an acid form. However, phosphorus is not eliminated from the bath until a basic slag is formed, but unlike sulphur which requires a hot and liquid slag, phosphorus unites with the lime while the latter is viscous and cold. The principle shown here is that the affinity of phosphorus for calcium diminishes as the temperature increases. With higher temperature, phosphorus unites again with iron to form phosphide, and under that condition the combination is broken up with great difficulty, if at all.

No one without a knowledge of chemistry can understand clearly all that takes place in a bath of metal when he brings about a change in the metal and slag. Knowledge of the chemistry alone is not sufficient without a background of experience in actual practice, or repeated observations of operation by practical men, noting what they do and the results which they obtain.

Chemistry dominates the process of reducing iron from the ore as well as all of the so-called oxidizing processes whereby the product of the blast furnace is refined and steel is made. However, reducing the iron from the ore, and refining this product to change it to steel is only about half of the story. What takes place when the many changes are wrought in the product after it is refined in one of the various processes is almost entirely of a physical nature, yet these changes are governed by laws as immutable as are the laws governing the chemical changes which take place in the various stages of refinement of iron and steel products.

In the smelting of iron ore the term *reduction* describes that process. Reduction in metallurgy means taking oxygen from the product to be recovered. The chief impurity in iron in the natural state is oxygen. There are other impurities contaminating iron ore, but aside from oxygen most of the impurities are a part of the gangue or earthy matter, and only need to be melted and fluxed to be separated from the iron. Indeed, if it were not for the presence of some of this dross, matter of like nature would have to be mixed with the charges to form a sufficient volume of slag so that the product would be under control in regard to the impurities contained in it. So, while the process by which iron is extracted from the ore is understood in metallurgical language to be reduction, all the processes by which iron is *purified* are oxidizing processes.

There is little danger of oxygen being found in solution with iron made under normal conditions of blast furnace operation, because, as said before, the smelting process is reducing. Of course, traces of iron oxide are found in all pig iron, but the amount found in iron made under normal operating conditions of a coke furnace is too small to cause any concern to those in charge of steel making processes. On the other hand, oxygen in some form, usually an oxide, is present in most steel making processes, and it is this element that gives the steel maker most cause for worry lest his product be contaminated with it to its detriment.

Knowledge of metallurgy is incomplete until something of the changes which take place in steel under the influence of hot working or heat treatment are known. Hot working refines the grain structure of steel. A certain amount of refinement is accomplished in the rolling operation other than grain refinement, that is, deep seated blow holes or gas cavities are welded up and do not appear in the product. However, when castings are made, the metal must be refined under conditions which preclude the formation of blow holes. It must be thoroughly deoxidized. At some later time approved methods of deoxidizing to insure solid castings free from gas cavities will be described.

Refinement of the grain structure of steel castings is accomplished by heat treatment, and there seems to be no limit to the changes which can be brought about in such properties as hardness, strength, and ductility by heat treatment. A knowledge of the solution theory of steel is helpful in gaining an understanding of what takes place in the arrangement of crystals in hot working or heat treatment. To understand the various properties of iron and steel—properties not conferred by hot working or heat treatment alone—it is helpful to know something of the constitution of both.

FIG. 2—OPEN-HEARTH FURNACES SUPPLY STEEL FOR THIS FOUNDRY WHICH IS DEVOTED MOSTLY TO HEAVY WORK

Fundamental ideas of the regenerative principle and of the gasification of fuels conceived by William and Frederick Siemens during the years 1857-1861 furnished the basis on which the open-hearth process of steel making was founded. From 1863 to 1867 William Siemens and the Martin brothers of France developed the pig and scrap method successfully, and by 1868 William Siemens had developed successfully the pig and ore process. Up to 1879 sand bottoms were in exclusive use as the basic process had not been discovered.

In 1879 the Thomas Gilchrist, or

basic process as applied to the bessemer converter was demonstrated as a commercial success at Middleborough, Eng., and its application to the open-hearth process was adopted rapidly. Samuel T. Wellman built the first successful open-hearth furnace in this country at the Bay State Iron Works, South Boston in 1869. Wellman and George W. Goetz about this time made steel on a basic bottom but discontinued the experiment after about four months.

Manufacture of the first basic open-hearth steel as a product of commerce was produced at the Homestead works, Carnegie, Phipps & Co., Homestead, Pa., March 28, 1888. The plant consisted of four small furnaces, having dolomite and tar bottoms, rammed in place while the furnace was cold. At the close of 1890 the Homestead works had 16 basic, open-hearth furnaces, varying from 15 to 35 tons in capacity. Considerable trouble in operation was encountered due mainly to bottom trouble. This fault persisted till long afterward, as it only has been eliminated during the last few years.

FIG. 3—DRY SAND MOLDS IN THIS FOUNDRY ARE DRIED IN OVENS WITH DOORS AT BOTH ENDS, AND FIRED WITH GAS OR OIL

Later magnesite was substituted for dolomite when putting in new bottoms, and instead of ramming the material in place it was discovered that it made a more satisfactory bottom when sintered in under the high heat of the flame. Conditions of sintering bottoms in place have improved with each succeeding year, as have other practices.

In 1890 approximately 90,000 tons of the total of 575,000 tons of steel produced by the open-hearth process was made on a basic bottom. Today the basic process alone produces nearly 30,000,000 tons of steel annually. A considerable tonnage goes into castings each year, and the amount will increase in direct proportion to the efforts of producers to improve the quality of the product.

In choosing the process best suited to a foundry to be put in operation a number of factors will have to be considered in making a choice. First, the class of product with which competition will occur will have to be considered. This factor will have considerable influence in the choice made because, whether justly or not, certain processes are supposed to produce a metal of definite quality, inherent in that process, and it would not be advisable to start out under a handicap which tradition has established.

Second, the tonnage the foundry could produce, and the intervals of pouring off that would best suit the class and volume of work which are expected to be made will have to be considered. In this respect the most desirable sequences of returning the flasks to the molders after pouring them will have to be determined for this involves the question of capital tied up in molding equipment.

Third, consideration will have to be given on whether the melting operation is to be continuous, or carried on only during the day. In the latter method just enough metal is melted in the last heat to suit the quantity of molds prepared. It often has proved advantageous to keep the melting operation continuous while operating the molding department during the day only, pouring at night excess molds which accumulate during the day. At other times melting operations are extended, making a long operating turn, or two short ones, during rushes. In such cases the flexibility of the electric furnace is useful and favors its choice as the melting unit. However, other factors must be considered, and as has been pointed out by other writers both the electric and the open-hearth processes have their advantages. Final choice is made after all of the factors which bear on each particular case have been considered carefully.

A foundry which starts out with a limited volume and variety of work, expecting to expand as the good will of customers is acquired, will find that the electric process is not too costly to install, and lends itself to great flexibility. The electric unit produces a product of high quality, but this quality and the cost of producing it depend on the knowledge of the man in charge of the melting operation. In some districts the cost of electricity would be too high for melting purposes but in others the rate is sufficiently low to make this means of melting attractive for the production of castings.

The open-hearth process is operated most economically when heats are produced regularly and continuously, with fewest intervals of idleness during the life of the furnace, that is, with least time taken off at the week-end during a furnace campaign. It requires considerable fuel to bring an open-hearth furnace up to the temperature required for refining steel and to attain the temperature necessary to pour the usual number of small castings of thin section.

It is one of the problems of the executive in charge to conserve this stored energy for it represents good hard dollars, and it is expensive to waft this energy up the stack or allow it to escape as radiation through the furnace walls. The tendency of open-hearth furnaces to lose heat at a rapid rate as soon as the flame is shut off militates against adoption where they must be run intermittently, and where long week-end shut-downs are necessary. However, where operations can be made continuous from one week-end to another the open-hearth process, acid and basic, has advantages.

Advocates of either the acid or basic open-hearth process can be found, and no doubt for certain classes of product requiring specific properties one may be better suited than the other, but in the main it is a question of preference. A product of high quality can be produced either by the acid or the basic open-hearth process.

Size of the melting unit may vary from about 1 or 2 tons to as much as 40 tons. Higher than 40 tons is not necessary or feasible unless the greater proportion of the work is of the heavy kind. Where small melting units are installed heavy castings cannot be made. However, it is possible approximately to double the capa-

(*Concluded on Page* 462)

One Piece Chassis

Replaces

Usual Assembled Construction

By Ernest V. Pannell

NOTWITHTANDING many widespread developments in the art of fabricating metals, it is true in most instances that given an alloy of the required properties, casting is the cheapest method of production. In the case of the light alloys of aluminum, the remarkably high physical properties now obtained by the use of modification or heat treatment, have opened up new fields in which these metals compete with those of heavier weight. For many years cast aluminum has been associated with a tensile strength of not more than 20,000 pounds per square inch and a negligible elongation. Foundry difficulties arising from shrinkage and hot shortness with the necessarily low casting temperature have limited the size and shape of castings.

More recently, however, light alloys have become available from which tensile strength of 25,000 to 35,000 pounds per square inch could be obtained with elongation amounting to from 5 to 10 per cent in 2 inches, or even higher. Casting difficulties at the same time have been reduced and larger molds poured. Much of this work has been accomplished in the United States particularly in the direction of large castings for architectural work and for naval purposes, but it is believed that the commercial possibilities have not been realized fully here as yet. While this may be partly due to the considerably increased use of aluminum alloy forgings in this country, it is a fact that in Europe certain lines of work in cast aluminum apparently have been developed more thoroughly than in America.

Attention may be drawn to the cast aluminum automobile chassis shown in the accompanying illustrations. A number of these have been produced in France by the Fondries et Forges de Crans for the de Lavand car. At the first glance, it will be seen that an interesting foundry job arises from the substitution of a casting for the more usual assembly of drop forged frames, cross-members, engine supports, torque tube and gear housings. It will also be observed that manufacture is simplified greatly by the virtual elimination of an assembled structure with its necessary bolts, rivets and welds. Further, it is evident that the strength of a homogeneous casting in which every section is designed for its proper load will probably be no less than that of an assembled steel chassis, for considered as a structure, the latter will have far less resistance to deformation than its individual members. In other words, the strength of the assembled structure is indeterminate while that of the casting can be reasonably well predicated.

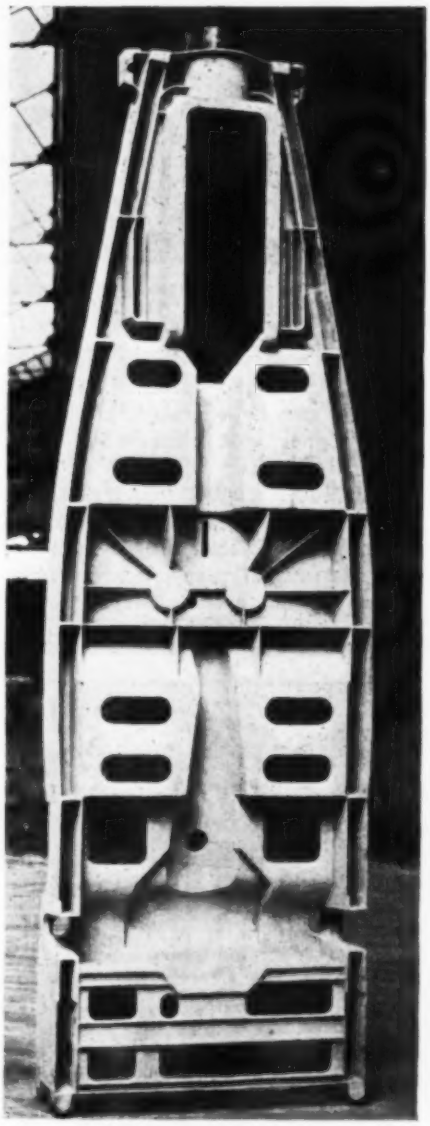


FIG. 1—BOTTOM VIEW OF THE CASTING SHOWING ITS LIGHT SECTION

Reduction in weight is not the least of the advantages derived from this all-aluminum chassis. The entire casting shown weighs only 364 pounds. It is 12 feet 1½ inches long and 3 feet 9 inches wide and the sections vary from 3/16 to ⅜-inch in thickness. When set up and loaded as a beam in its center the chassis has carried a load of 6600 pounds with an elastic deflection of only 0.2-inch.

Because of the rigidity of the cast chassis a three point suspension is provided which comprises the extremities of the rear axle and the center of the front axle. The front suspension is mounted on a large diameter steel dowel which is set in the mold and cast in. This allows the necessary oscillation of the front axle without distortion or straining the frame.

A 13 per cent modified sillicon alloy is used for this casting which is, of course, poured in a green sand mold. The alloy is well known in the United States having been developed there first. It was adopted for special reasons. In the first place, it is eutectic composition, in other words, after being poured the casting solidifies at a definite temperature. There is no intermediate stage as in the case of many other aluminum alloys where the metal is neither fluid nor solid. This is an important fact in

producing large and complicated castings with considerable changes in section because it is a matter of experience that cracks and draws develop mainly during the solidifying stage when the metal is at its weakest. The low shrinkage associated with this metal is also an important advantage for such a casting.

In the foundry of Fonderies et Forges de Crans, a wide variety of automotive castings is produced in light alloys. The entire frame of a sedan body is so cast, sheet aluminum paneling being attached in the body plant. Rear axle housings, brake drums, frame cross members, clutch housings, and instrument boards indicate how wide a field can be developed in the automobile industry for simple aluminum sand castings.

Further work similar to the above has been carried on in Germany by the Metallbank and a complete car body has been cast in one piece on an experimental scale. This has been produced in an alloy practically identical with the one mentioned previously. This alloy has a tensile strength of 27,000 to 33,000 pounds per square inch and an elongation of 5 to 10 per cent.

Hold Diamond Jubilee

The annual meeting of the British Iron and Steel institute was held May 2 and 3 at the Institution of Civil Engineers, London, and included the celebration of the sixtieth anniversary of the founding of the institute. Benjamin Talbot, Cargo Fleet Iron Co. Ltd., presided over the opening session and was followed by Professor Henry Louis, new president of the institute. His first act was to present the Bessemer gold medal to Sir Charles Parsons in recognition of his services in development of engineering science in the manufacture of iron and steel. He then presented his presidential address which included a short history of iron manufacture and stated that progress in the industry was due to increasing control over the production of heat.

Making Steel Castings

(*Concluded from Page 460*)

city of the furnace for a heat or two to pour an unusually heavy casting. Where there are two or more furnaces it is possible to tap them simultaneously to pour a casting which requires more steel than one furnace will make at one time.

Furnaces smaller than about 10 tons for the basic open-hearth process are not recommended for then it is a problem to produce a good, clean steel.

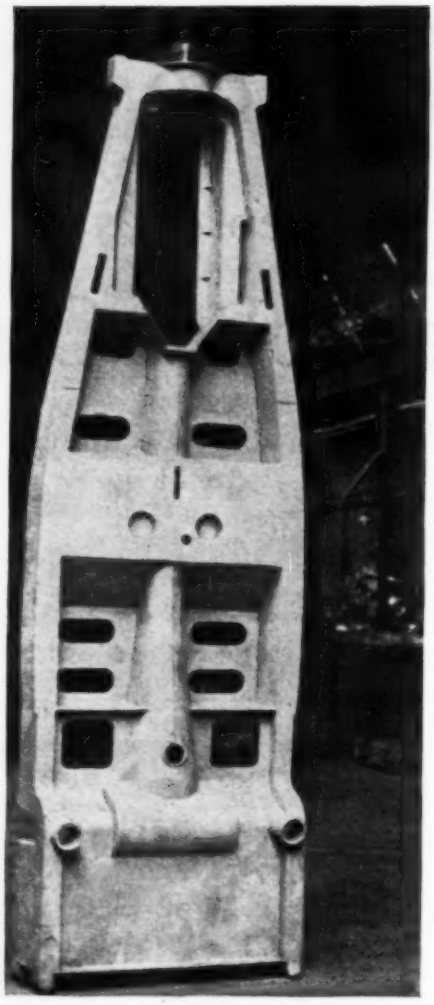


FIG. 2 — CAST AUTOMOBILE CHASSIS VIEWED FROM THE TOP

With the acid process size makes little difference, and furnaces of 5 tons capacity can be operated, but always at a higher cost than when larger heats are made.

In building a steel foundry the furnace department should be laid out according to plans incorporating the best features of plants already in existence so that production will be high and a good product will be obtained.

Add Rosin to Wax

By Frank C. Doran

At times, when a metal pattern, from which only one or two castings are to be made, is being finished in the pattern shop, beeswax is used for fillets and for filling small holes and defects. Occasionally some difficulty is experienced in making the beeswax adhere to the pattern. One of the simplest and best remedies for this situation is to add a small piece of ordinary rosin to the melted wax. If the beeswax is melted in a small ladle about half the size of a teacup, add a piece of rosin the size of a marble and allow it to dissolve. If the mixture then is used in the ordinary manner, it will stick to the surface without any trouble.

Speaks to Foundrymen

Operation of the foundry cupola was the subject of discussion at the regular May meeting of the New England Foundrymen's association, held at the Exchange club, Boston, May 8. Dr. Edward W. Marbaker, Whiting Corp., Harvey, Ill., was the principal speaker.

Wisconsin Group Meets

A meeting of the Wisconsin Gray Iron Foundry Group was held at the Hotel Schroeder, Milwaukee, May 1. B. V. E. Nordberg, executive engineer, Nordberg Mfg. Co., Milwaukee, spoke on "Pattern Design in Relation to Molding."

Charles Strom, formerly with the Fisk Tire & Rubber Co., Akron, O., has become affiliated with the export sales department of the Black & Decker Mfg. Co., Towson, Md., and after a brief period at the plant, will represent the company in foreign markets.

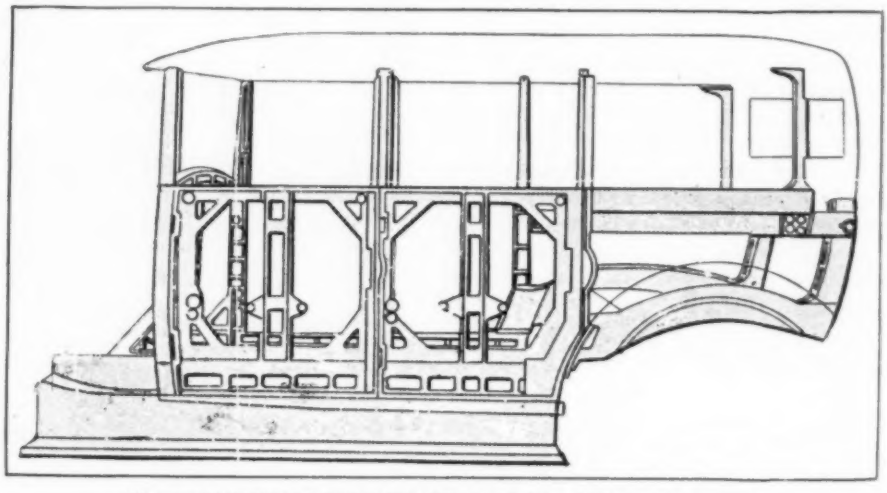
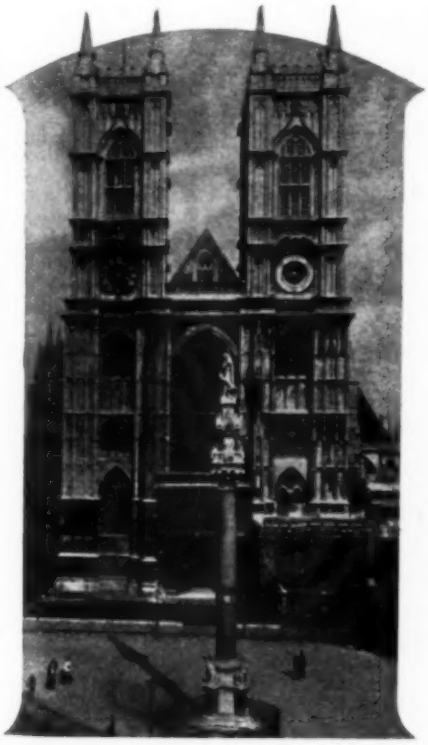


FIG. 3—SKETCH OF BODY FRAME CAST IN ALUMINUM ALLOY

British Industries Open Doors to American Foundrymen

AMERICAN foundrymen will be well represented at the International Foundrymen's Congress, to be held in London, June 11 to 14. A party of approximately seventy, composed of officers of the American Foundrymen's association, leading foundrymen and equipment and supply manufacturers have taken advantage of the splendid opportunity offered to visit the principal industrial establishments of England and the Continent, to hear the technical papers and discussions on various important phases of the foundry industry and to see the large display of foundry equipment and supplies to be shown in Royal Agricultural Hall, London, during the convention.

The first party of American foundrymen arrived in London on May 19 on the S. S. CARMANIA and the second group arrived a day later on the S. S. BERENGARIA. Various other American visitors, who made the trip to Europe at an earlier date, joined the main party in London. The first week in the world's largest city was devoted to sight seeing trips and excursions to various points of interest in the immediate vicinity of London.



The Famous Westminster Abbey

On Monday morning, May 20, the American Foundrymen's association delegation was received officially by the Institute of British Foundrymen, the ceremony taking place in the Hotel Cecil. Speeches were made by Wesley Lambert, president elect of the Institute of British Foundrymen; H. G. Sommerfield, secretary of the London branch of the Institute of British Foundrymen; S. T. Johnston, president of the American Foundrymen's association, and Fred Erb, president elect of the American Foundrymen's association. A dinner for the delegation was held at the Holborn restaurant on Thursday, May 23, at the invitation of Sir Hugo Hirst, chairman of the British General Electric Co. Sir Hugo Hirst and W. B. Lake, president, London branch of the institute, welcomed the visitors on behalf of the I. B. F. Responses were made by S. T. Johnston and H. Cole Estep.

A tour covering the most important industrial and foundry centers in Great Britain was arranged by the Institute of British Foundrymen. This tour, planned also to afford opportunity for inspecting places of scenic, historic and literary interest, will extend until the opening of the Congress.

On Monday, May 27, the party left London by rail for Leamington, where visits were made to Warwick castle, Stratford-on-Avon, the birthplace of Shakespeare, and Kenilworth castle. The party continued to Birmingham by rail in the afternoon. At Birmingham the party visited important foundries located in that famous industrial city. Special excursions were planned for the ladies and an official reception was held by the Birmingham branch of the I. B. F. for all foundrymen and ladies. On Wednesday, May 29, the party continued to Derby, where the delegates visited foundry and engineering works and the ladies inspected the Royal Crown Derby Porcelain Works. The party then proceeded to Matlock Bath in the Derbyshire Peak District for dinner.

The following day visits were made to foundries near Derby and at Lochborough. Later in the day the party proceeded to Manchester, where a reception was held in the town hall by the Lord Mayor of Manchester. On Friday, May 31, visits were planned to foundries and engineering companies in Manchester, Liverpool and Oldham. The ladies in the party were scheduled to visit Cheltham's Hospital, John Rylands Library, College of Technology and a model village at Port Sunlight.

The pre-convention tour program, extending from Saturday, June 1 to Monday, June 11, is presented in the box on page 464.

Several postconvention tours have been arranged for the American party.

Guildhall, Scene of the First Session

One consists of a trip to Paris, France, where many of the points of interest in the most beautiful metropolis of Europe will be viewed. The party making the trip to Paris will sail from Havre on the S. S. CARMANIA on Saturday, June 22, and will arrive in New York on Monday, July 1.

The second postconvention tour will include a trip to Ostend, Brussels, Liege, Cologne, Heidelberg, Strasbourg, and Paris. The party making that trip will sail from Havre on the S. S. TUSCANIA on June 29 and will arrive in New York on Monday, July 8.

Included among the American delegation attending the London meeting are the following:

C. H. Gale, Grand Rapids, Mich.
L. W. Olson, Director, Past President, A. F. A., Ohio Brass Co., Mansfield, O.
Mrs. W. L. Olson.
S. W. Utley, Director, Past President, A. F. A., Detroit Steel Castings Co., Detroit, Mich.
Mrs. S. W. Utley.
Dan M. Avey, Editor, THE FOUNDRY, Cleveland.
Mrs. Dan M. Avey.
R. F. Harrington, Hunt-Spiller Mfg. Co., Boston.
C. E. Hoyt, Executive Secretary-Treasurer, A. F. A., Chicago.
Mrs. C. E. Hoyt.
James W. Gibney, W. P. Taylor Co., Buffalo.
George F. Snyder, Snyder Foundry Supply Co., Los Angeles.
Mrs. George F. Snyder.
E. M. Ayers, Ayers Mineral Co., Zanesville, O.
J. B. Goostray, Hunt-Spiller Mfg. Co., Boston.
George H. Wadsworth, Wadsworth Core Machine & Equipment Co., Akron, O.
Mrs. George H. Wadsworth.
E. L. Loges, Kramer Bros. Foundry Co., Dayton, O.
H. Cole Estep, Director, Chairman, A. F. A. Committee on International Relations, Penton Publishing Co., Cleveland.
Mrs. H. Cole Estep and Master Edward Estep.
Joseph F. Frogget, Penton Publishing Co., Cleveland.
A. E. Hageboeck, Director, Frank Foundries Corp., Moline, Ill.
Mrs. A. E. Hageboeck.
P. W. Mulder, Almont Mfg. Co., Almont, Mich.
Mrs. P. W. Mulder.
V. E. Minich, American Foundry Equipment Co., New York.
S. T. Johnston, President, S. Obermayer Co. and National Engineering Co., Chicago.
Mrs. S. T. Johnston.
R. E. Bryant, Jefferson Union Co., Lockport, N. Y.
Mrs. R. E. Bryant.
Fred Erb, President-elect, A. F. A., Erb-Joyce Foundry Co., Detroit.
Mrs. Fred Erb.
Wm. W. Paulson, Thomas Paulson & Son, Inc., Brooklyn, N. Y.
Mrs. Wm. W. Paulson.
Wm. J. Grede, Liberty Foundry, Inc., Wauwatosa, Wis.
Mrs. Wm. J. Grede.
E. N. Cabaniss, Joseph Dixon Crucible Co., Jersey City, N. J.
J. S. Law, Joseph Dixon Crucible Co., Jersey City, N. J.
R. E. Kennedy, Technical Secretary, Chicago.
James T. MacKenzie, American Cast Iron Pipe Co., Birmingham.
M. J. Evans, Whiting Corporation, Harvey, Ill.
Mrs. M. J. Evans.
Robert Crawford, Atlas Foundry Co., Detroit.
Mrs. Robert Crawford.
Miss Crawford.
R. W. McIlvaine, R. W. McIlvaine Co., Chicago.
Mrs. R. W. McIlvaine.
Edward Frohman, S. Obermayer Co., Pittsburgh.
Herbert Weaver, Canadian Foundry Supplies, Ltd., Montreal, Can.
Wm. H. Nicholls, Wm. H. Nicholls Co., Inc., Brooklyn, N. Y.
Robert J. Turnbull, Arcade Mfg. Co., Freeport, Ill.
John C. Pangborn, Pangborn Corp., Hagerstown, Md.
Frank Dodge, Werner G. Smith Co., Detroit.
Mrs. Frank Dodge.
H. B. Hanley, Whitehead Bros. Co., Rochester, N. Y.
Mrs. H. B. Hanley.
W. B. Willard, Grand Rapids, Mich.
Mrs. Kirk, Detroit.
F. R. Ringle, Herman Pneumatic Machine Co., Pittsburgh.
Thomas Kaveny, Jr., Herman Pneumatic Machine, Co., Pittsburgh.
H. A. Schwartz, National Malleable & Steel Castings Co., Cleveland.
Mrs. H. A. Schwartz.
T. C. Calhoun, Johnston & Jennings Co., Cleveland.
Mrs. Calhoun.

Information Offices

DURING the congress, offices will be maintained at various points where tickets and booklets will be issued and general information be obtained. Location of the offices will be as follows:

Monday, June 10

5 to 8 p.m.—The Institution of Mechanical Engineers.

Tuesday, June 11

10 a.m. to 12 noon—The Guildhall.
2.30 to 4.30 p.m.—The International Foundry Exhibition, Agricultural Hall.

Wednesday, June 12

10. a.m. to 12 noon—The Institution of Mechanical Engineers.
2.30 to 4.30 p.m.—The Foundry Exhibition.

Thursday, June 13

10 a.m. to 12 noon—The Institution of Mechanical Engineers.

Nickel Subject of Talk

An address entitled "Application of Nickel to Gray Iron" was presented at the May meeting of the Philadelphia Foundrymen's association, at the Manufacturers club, Philadelphia, May 8. J. S. Vanick, of the International Nickel Co., was the speaker of the evening. His address was illustrated by lantern slides.

Acquires Machinery Firm

J. D. Wallace & Co., Chicago, manufacturers of portable woodworking machinery, has taken over the John T. Towsley Mfg. Co., Cincinnati. The Towsley company will continue to operate under its present name as a division of the Wallace Co.

Convention Visitors Tour Great Britain

Saturday, June 1

A trip from Manchester to Keswick by motor coach (100 miles) through the English Lake district, this will permit party to see some of the most beautiful scenery in the country.

Stay overnight at hotels in Keswick and district.

Sunday, June 2

The party will go to Glasgow by motor coach. (148 miles), passing through the attractive mountain region of the Scottish Lowlands.

Monday, June 3

In Glasgow. Arrangements in Scotland will be made by Scottish branch I. B. F.

Steamer excursion down River Clyde for delegates and ladies. This trip will start from Broomielaw passing enroute shipbuilding yards, then by way of Cowl, Rothesay bay, Kyles of Bute, returning to Greenock or Gouroch then to Glasgow by train.

Civic reception by lord provost will be held in the evening.

Tuesday, June 4

Party continues by motor coach from Glasgow via the west bank of Loch Lomond to Balloch, Inversnaid.

Ardlui, Glen Falloch, Crainlarich to Lochearnhead.

Lunch at Lochearnhead hotel.

Continue by motor coach via Strathye, Callander, Trossachs Pier, Doune, Stirling and Linlithgow to Edinburgh. (About 150 miles).

Wednesday, June 5

Morning will be spent in Edinburgh; one of the most beautiful and historic cities in Great Britain, and the old capital of Scotland.

In the morning a motor coach trip will be made to South Queensferry and Forth Bridge. The party then will return to Edinburgh to visit the Scottish National War Memorial at Edinburgh castle and Holyrood palace.

After lunch the tour continues by motor coach to Newcastle via, Lauder, Melrose, (ancient Abbey), Abbotsford (residence of Sir Walter Scott), Dryburgh, Jedburgh and Otterburn.

Thursday, June 6

In Newcastle-on-Tyne. Arrangements by Newcastle branch I. B. F.

In the morning the delegates may visit foundries or may take part in an excursion on the River Tyne.

A visit to North East Coast exhibition, embracing the industries of Northeastern England will be made in the afternoon.

Civic reception will be held at the exhibition. Reception will be held in the evening.

Friday, June 7

Party continues by motor coach to Sheffield via Ripon (Cathedral), Fountains Abbey, Harrogate (Famous health resort) and Leeds. Reception will be held on arrival in Sheffield.

Saturday, June 8

In Sheffield and district.

Visits to works will feature the morning program.

Civic reception and excursion to Derbyshire Dales will occupy the afternoon.

Sunday, June 9

Leave Sheffield by rail for London.

Monday, June 10

At leisure in London.

London *Welcomes* World Foundrymen

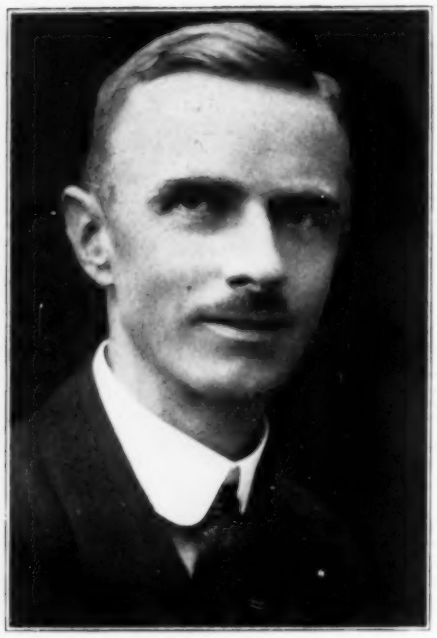
THE germ of the idea which since has developed into an important movement, known as the international foundry congress, first was given an airing by the late A. O. Backert on a European good will tour during his term of office as president of the American Foundrymen's association in 1919. The movement began to take tangible shape the following year with an agreement for the exchange of technical papers. Further impetus was given the project at the nineteenth annual meeting of the Institute of British Foundrymen held in Birmingham, England June 21-23, 1922 in connection with the first British exhibition of foundry equipment and supplies.

At that meeting Oliver Stubbs, managing director Joseph Stubbs, Ltd., Manchester and retiring president of the Institute, invited representatives of the other foundrymen's associations present to a luncheon for the express purpose of discussing the feasibility of holding an international foundry congress in regular rotation in a selected list of countries. As a result of that informal gathering it was decided to hold the first international congress in Paris in 1923 under the auspices of the several continental European countries prominently engaged in the casting industry with the Association de Technique de Fonderie de France as the official host.

With the appointment of an international committee, definite arrangement was made to hold this international congress once every three years in four countries, namely England, France, Germany and the United States. This will provide an interval of 12 years between two meetings of the congress in any one country. Thus the first congress was held in Paris, France, Sept. 12 to 18, 1923. The second was held in Detroit, Sept. 27 to Oct. 1, 1926. The third will be held in London, England, June 11 to 15, of this year. The fourth is scheduled for Duesseldorf, Germany, 1932. The cycle then will be repeated.

The third International Foundrymen's congress, which opens in London, June 11 to 15, under the auspices of the Institute of British Foundrymen is held in conjunction with an International Foundry Trades exhibition staged at the Royal Agricultural hall, in London, June 5 to 15. This exhibition is under the auspices of the Foundry Trades Equipment & Supplies Association, Ltd., with the management of the show placed in the hands of F. W. Bridges & Sons, Ltd., London.

The following organizations have been invited to participate in the International Foundrymen's congress: American Foundrymen's association, Association Technique de Fonderie de Belgique, Association Technique de Fonderie de France, Association de Fonderie Tcheco-Slovaque, British Cast Iron Research association, Foundry Equipment Manufacturers association, (United States)



S. H. RUSSELL
Retiring President, I. B. F.

WESLEY LAMBERT
Incoming President, I. B. F.

Foundry Trades Equipment & Supplies Association, Ltd., (British) Institute of British Foundrymen, Society of Dutch Iron & Steel Founders, Sveriges Gjutmastereforbond, Sweden; Verein Deutscher Eisengiessereien, Verein Deutscher Giessereifachleute, and the foundrymen of Italy, Spain, Luxemburg, Switzerland, Norway, Denmark, South America, South Africa, India, Australia and New Zealand, etc.

The International Foundrymen's congresses represent a great world movement among foundrymen to improve practice, exchange ideas on a constructive basis, and to co-operate in the development of industry and commerce throughout the world. Beyond this, in the language of S. T. Johnston, president of the American Foundrymen's association, this great co-operative movement among foundrymen "further represents a genuine effort to promote international good will and understanding. The International Foundrymen's congress," said Mr. Johnston "is a factor contributing to peace and stability throughout the world. I wish it were possible for every member of the American Foundrymen's association to attend." The foundry industry is the only one which is organized throughout the world on a definite basis. The international congresses are no longer in the experimental stage. Their success is assured and the definite benefits accruing to the foundry industry of the world have been demonstrated.

The Lord Mayor of London, Sir Kynaston Studd, graciously has accepted an invitation to give an address of welcome to the foreign vis-

I. B. F. Officers Greet Congress Visitors

THE members of the Institute of British Foundrymen are looking forward with very great interest to the visit of overseas delegates to the London International Foundrymen's Congress in June next. Our visitors will find that we are anxious to show them all we can, are prepared to share with them the technical and practical knowledge we possess, and we know that they on their part are anxious to reciprocate and to co-operate with us in the free exchange of knowledge and experience.

Those of us who took part in the international convention at Detroit three years ago made many friends, not only with our hosts, but also with members of other European nations who joined in the tour, and in whose company we traveled several thousands of miles.

We are hoping to meet in London many of these again, and we are pleased to see in the preliminary list of visitors from the United States of America the names of some of our friends who did so much to make this trip such a memorable one.

S. H. Russell

President
Institute of British Foundrymen

IN ASSOCIATING themselves with the sentiments uttered by our president, our members gladly take this opportunity to express the hope that all our visitors from overseas and from the continent of Europe will benefit from their reunion with their British friends on the occasion of the London International Foundrymen's Congress.

This being the third gathering of its kind, we are particularly happy to have the opportunity to reciprocate the hospitality and the courtesies shown to us by the American Foundrymen's Association in Detroit in 1926, and by the Association Technique de Fonderie in Paris in 1923.

May all our friends find interest and pleasure in the papers that will be presented to them, in the various features of the foundry exhibition, in the works that they will see, and in their visits to different parts of the country. May the bonds that unite the foundrymen of all nations be strengthened by the happy memories which we hope they will preserve from their visit to Great Britain.

Wesley Lambert

President-elect
Institute of British Foundrymen

Program for International Congress Papers

THE program of the International Foundrymen's Congress has been arranged so that the mornings will be devoted to the presentation of papers and discussions, the afternoons to inspection trips, and the evenings to social events. The program is as follows:

Monday, June 10

6.00 p.m.—General council meeting at the Institution of Mechanical Engineers, Storey's Gate, St. James's Park, S.W. 1. Nearest tube stations—St. James Park and Westminster.

8.00 p.m.—Annual general meeting of the institute, open to all members, associate members and associates, at the Institution of Mechanical Engineers, Storey's Gate, St. James's Park, Westminster, S.W.1.

Tuesday, June 11

10.00 a.m.—Congress commences in the Grand Council chamber of the Guildhall of the City of London. Nearest tube stations—Bank, Moorgate and Mansion House. Official welcome by the Rt. Hon. the Lord Mayor of London (Sir Kynaston Studd, O.B.E.).

11.00 a.m.—Presidential Address by Mr. Wesley Lambert. Presentation and discussion of Papers.

12.30 p.m.—Conference adjourns.

Afternoon—Optional visit to works of Messrs. Fraser & Chalmers' Engineering Works, proprietors, The General Electric Co., Limited, Erith, Kent; Messrs. Dewrance & Co., 165 Great Dover street, S.E.1; The United Glass Bottle Manufacturers, Ltd., Charlton.

4.30 p.m.—Reception at the Guildhall by invitation of Sir John Dewrance, K.B.E. All members, delegates, and ladies are invited.

Evening free.

Wednesday, June 12

9.30 a.m.—Congress continued at the Institution of Mechanical Engineers, Storey's Gate, St. James's Park, S.W. 1. Presentation and discussion of Papers.

12.30 p.m.—Congress adjourns.

Afternoon—Members and delegates' optional visit to works of Messrs. Kryn & Lahy (1928), Ltd., Letchworth, Herts; Messrs. J. & E. Hall, Ltd., Dartford Ironworks, Kent; Messrs. Lake & Elliott, Ltd., Braintree, Essex.

7.00 p.m.—Annual banquet at the Hotel Cecil, Strand, W.C.2, for members, delegates and ladies. Nearest tube stations to Hotel Cecil—Trafalgar square, Charing Cross and Strand.

Thursday, June 13

9:30 a.m.—Congress continued at the Institution of Mechanical Engineers, Storey's Gate, St. James's Park, S.W. 1. Presentation and discussion of Papers.

12.00 noon—Conference adjourns.

1.15 p.m.—Luncheon to overseas delegates at the International Foundry exhibition, Royal Agricultural hall, Islington, N.1, by invitation of the organizers, Messrs. F. W. Bridges & Sons, Ltd.

2.30 p.m.—Official visit to the International Foundry Trades' exhibition, Royal Agricultural hall, Islington, N.1.

4.30 p.m.—Tea to all members of the institute and delegates at the International Foundry exhibition, by invitation of Messrs. F. W. Bridges & Sons, Ltd.

8.00 p.m. to 12 midnight—Dance and cabaret at the New Burlington Galleries, Burlington Gardens, W.1, by invitation of the conference committee and the Foundry Trades' Equipment & Supply association Ltd. Nearest tube station—Dover Street (Central London Railway).

Friday, June 14

10.00 a.m.—Excursion to Canterbury for members, delegates and ladies. Motor coaches leave Embankment. Lunch at the "Tudor House," Bearstead, Kent.

4.00 p.m.—Leave Canterbury for return journey and tea at the "Tudor House," Bearstead, Kent.

Technical Papers

"Some Inter-Relationships in Gray Iron Metallurgy," American exchange paper, by J. W. Bolton, Lunkenheimer Co., Cincinnati.

"The Desulphurization of Iron and Steel," presented on behalf of the Polish Foundrymen, by K. Gierdziejewski.

"Cast Iron Testing Methods," French exchange paper, by M. Le Thomas, past president, Association Technique de Fonderie de Paris.

"Testing in Relation to the Design of Castings," by J. G. Pearce, director and secretary, British Cast Iron Research association, Birmingham.

"The Influence of Chromium in Cast Iron," by J. W. Donaldson, Scott's Shipbuilding & Engineering Co., Ltd., Greenock.

"Influence of Manganese in Cast Iron," by A. L. Norbury, Birmingham.

"The Practical Application of Nickel in Cast Iron," by A. B. Everest, Birmingham.

"Practical Points from the Metallurgy of Cast Bronzes," by H. C. Dews, Dewrance & Co., London.

"Die Castings," by A. H. Mundey, London.

"Staffing for the Foundry Industry," Belgian exchange paper.

"The Problem of Foundry Molding-Sand," by H. Van Aarst, presented on behalf of the Dutch Foundry Technical association.

"Coal-Dust as Applied to Molding-Sands," by B. Hird.

"The Application of Pulverized Fuel," by H. W. Hollands and E. Lowndes.

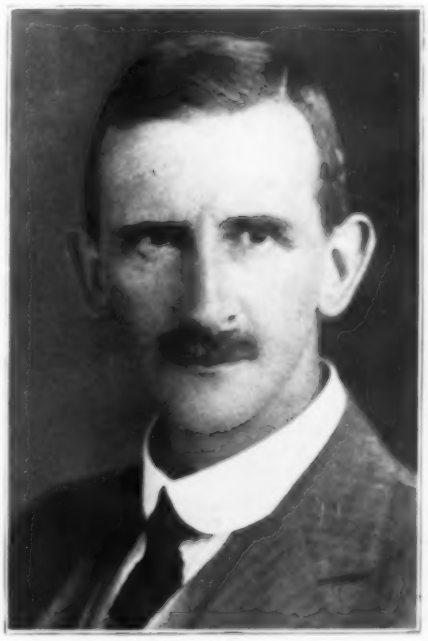
"Steel Castings," by R. H. Greaves.

itors at the opening session of the International Foundry congress, at Guildhall, London. This is an exceptional honor, and as a result the opening ceremony will be particularly brilliant, as it will take place in an historical building of outstanding interest with the first citizen of the city of London present. This event reflects most honorably on the foundry industry as a whole, and particularly on the Institute of British Foundrymen, acting as host. This organization already in the past has received official recognition and holds a royal charter.

Further illustration of the importance attached to the International Foundrymen's congress by the official representatives of the City of London is shown by the fact that, through the good offices of H. G. Sommerfield, honorary secretary of the London reception committee, the Court of Common council has granted permission for the opening session of the convention to be held in the Grand Council chamber of the London Guildhall. The Grand Council Chamber of the Guildhall is thrown open to such meetings only on rare occasions, and this gesture of goodwill on the part of the authorities should be regarded as a great honor conferred on all those taking part in the congress. It also is an expression of goodwill on the part of the City of London toward visitors.

The chairman of the Court of Common council has further granted the use of the Guildhall in the afternoon of the same day, so that the delegates may visit this interesting historical monument. On that occasion

THOMAS MAKEMSON
General Secretary, I. B. F.



F. P. WILSON
Vice President, I. B. F.

the organizers of the convention will hold a reception at the Guildhall. All members, delegates and ladies are invited to the reception.

The Guildhall, which is the council hall of the corporation of the City of London, was rebuilt immediately after the great fire of 1666. The original building was erected in 1411-39, and the porch, as seen today, dates from 1425. The crypt, where a reception probably will be held in the afternoon of the first day of the convention, also dates back to the fifteenth century. The history of the corporation itself can be traced to the time of the Norman invasion, when the citizens made terms with the conqueror and received at his hands confirmation of their old charter. The Grand Council chamber, where the opening session will be held, was built in 1883-84. It is beautifully decorated, and the height from floor to dome is 61 feet 6 inches. It is duo-decagonal in shape and contains 12 richly canopied carved screens, which divide the chamber from the corridor. These screens are executed in wainscot glazed with ornamental lead-lights, having the arms of the various livery companies. The crypt is 77 feet by 46 feet, and the height from the pavement to the crown of the arches is 13 feet. Many shields bearing the arms of King Edward the Confessor, the arms of England and Russia, the arms of the city of London can be seen. The Guildhall library contains 6000 manuscripts and over 185,000 volumes. The whole building can be looked upon as a history in stone of the City of London.

The Institute of British Foundryment has arranged an exceptionally interesting program of technical papers for presentation at various meetings during the congress. The list included exchange papers sponsored by American, French, Belgian, Dutch and Polish associations and numerous contributions from members of the British organization. The sessions on Wednesday and Thursday, at which papers will be read and discussed, will be held at the Institution of Mechanical Engineers, Storey's Gate, St. James Park, S.W.1.

As previously mentioned, the congress will open Tuesday morning, June 11, in Guildhall. After the official welcome by the Lord Mayor, Wesley Lambert, president-elect of the Institute of British Foundrymen, will be inducted into office and will deliver the presidential address. Presentation of papers will occupy the remainder of the morning session. The afternoon will be devoted to optional visits to the works of Messrs. Fraser & Chalmers' Engineering Works, proprietors, the General Electric Co. Ltd., Erith, Kent; Messrs. Dewrance & Co., and the United Glass Bottle Manufacturers Ltd., Charlton. No special features have been planned for the evening.

The congress will continue at 9:30 Wednesday morning at the Institution of Mechanical Engineers. Presentation of papers and discussion will constitute the program at that session. An optional inspection trip for members and delegates has been planned for the afternoon. The visit will be to the works of Messrs. Kryn & Lahy Ltd., Letchworth, Herts; Messrs. J. & E. Hall Ltd., Dartford Ironworks, Kent; Messrs. Lake & Elliott Ltd., Braintree, Essex. The annual banquet will be held in the evening at the Hotel Cecil.

The last technical session will be held Thursday morning. At 1 p. m. F. W. Bridges & Sons Ltd., organizers of the International Foundry exhibit, will give a luncheon for the overseas delegates in Royal Agricultural hall, the scene of the equipment show. The afternoon will be devoted to inspecting the exhibition. At 4:30 p. m., tea will be served for the delegates and members. A dance and cabaret will be held in the evening at the New Burlington Galleries, Burlington Gardens, by invitation of the conference committee and the Foundry Trades' Equipment & Supply Association Ltd.

Members, delegates and ladies will leave at 10 a. m. Friday for an excursion to Canterbury. Luncheon will be served at the Tudor House, Bearstead, Kent.

International Foundry Trades exhibition which will be held in Royal Agricultural hall, London, June 5 to 15, in connection with the international foundry congress will be of wider scope than any previous foundry exhibition that has been held in Great Britain.

This year the show will include a large section devoted entirely to imported machine tools and woodworking machinery. This exhibition-within-an-exhibition will be the first practical display of its kind in the country, and as it will be composed of the products of some of the largest machine tool and woodworking machinery firms supplying the British market, it will have a special interest to American visitors.

Activities of the exhibition are bound up with the Foundry Trades' Equipment & Supplies association, the president of which is H. Winterton, managing director of William Cummings & Co. Ltd., Kelvinvale Mills, Maryhill, Glasgow, Scotland, the vice presidents being: A. S. Beech, director of the Universal System of Machine Molding & Machinery Co. Ltd., London; D. W. Lennox, managing director of the Britannia Foundry Co. Ltd., Coventry; D. H. Wood, managing director of the Constructional Engineering Co. Ltd., Birmingham.

Material organization of the exhibition is handled by F. W. Bridges & Sons Ltd., London, who will entertain the convention officials from overseas at a luncheon and will serve tea to all members and delegates.

A special feature of the exhibition will be the technical, noncommercial and research exhibit, which is organized with the whole-hearted co-operation of a strong committee and has the support of government departments, universities, institutions, and the laboratories of the largest private firms. The technical committee that supports this technical exhibit is composed of well-known metallurgists associated with many industrial establishments and various colleges.

Attend Congress

PHOTOGRAPHS of the following important foundrymen attending the International Foundrymen's congress in London are reproduced on the opposite page.

K. W. BRIDGES
Honorary Secretary, Foundry Trades' Equipment & Supplies association.

H. C. DEWS
Metallurgist, Dewrance & Co., London, Member of Council of I. B. F.

J. M. ESPANA
Vice President for Spain of Association Technique de Fonderie de France

V. FAULKNER
Editor, *The Foundry Trade Journal*, Past President I. B. F.

S. T. JOHNSTON
President, American Foundrymen's association

W. B. LAKE
Lake & Elliott, Braintree, Essex, President London Branch, I. B. F.

J. G. PEARCE
Director and Secretary, British Cast Iron Research Association, Birmingham

PROF. PISEK
President, Czecho-Slovakian Technical Foundry association

MARCEL REMY
President, Association Technique de Fonderie de Belgique

E. V. RONCERAY
Vice President, Association Technique de Fonderie de France

H. G. SOMMERFIELD
Secretary, London branch, I. B. F.

LEON THOMAS
President of Honor, Association de Fonderie de France

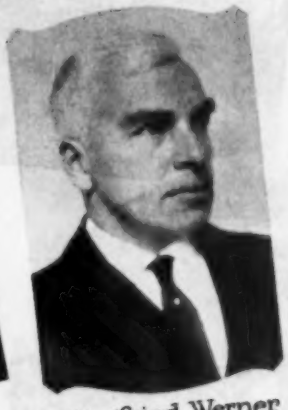
SIEGFRIED WERNER
President, Verein Deutscher Giessereifachleute

J.M. España

W.B. Lake

Marcel Rémy

V. Faulkner



Siegfried Werner

J.G. Pearce

Leon Thomas

H.C. Dews

S.T. Johnston

H.G. Sommerfield

K.W. Bridges

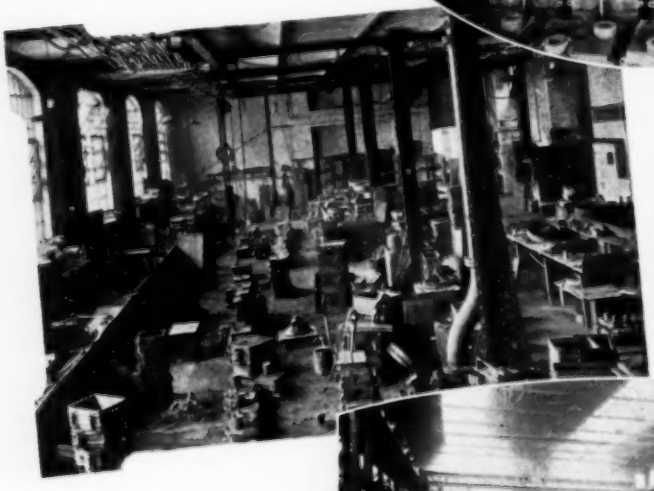
Prof. Pisek

E.V. Ronceray

Convention Visitors See Many

VIEWS of the Ley's Malleable Castings Ltd., Derby, Are Shown Above and at the Right. The Illustration Above Gives a View of the Annealing Shop, and That at the Right Shows the Bay in the Foundry With the Furnace in the Background

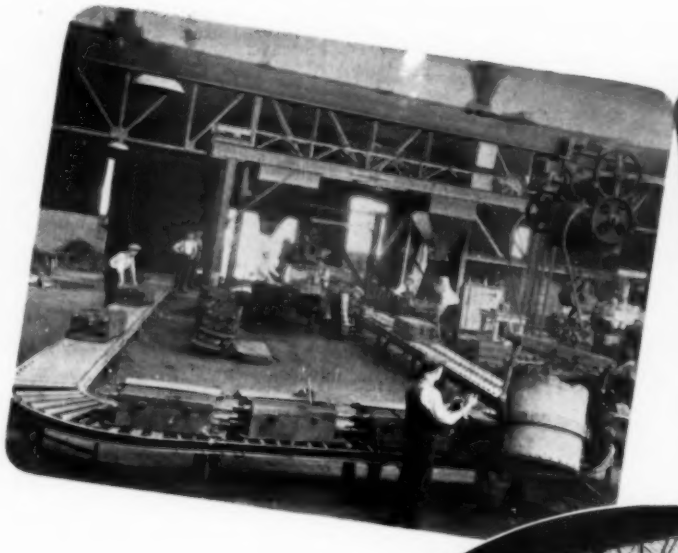
ALUMINUM Automotive Castings Are Made Continuously at the Midland Motor Cylinder Co. Ltd., Birmingham, Shown Above. Pattern Machines Are Mounted on a Turntable and Sand Is Supplied by a Sandslinging Machine at the Table's Edge



FOUNDRY of Dewrance & Co., London, Bronze Founders, Is Shown Above. Right—General View of the Iron Foundry of Rolls-Royce Ltd., Derby, Showing the Cupola in the Background. At the Right Is a Jolt Rollover Molding Machine for Making Cylinder Blocks

SOHO Foundry of W. & T. Avery Ltd., Birmingham, Is Shown Above. The Original Foundry Was Erected by James Watt and Matthew Boulton for the Building of the First Steam Engines in 1796. Some of the Old Machinery Installed Still Exists

Interesting English Foundries



CONTINUOUS Unit Installed in the Pipe Fitting Foundry of Stanton Iron Works Co. Ltd., Near Nottingham, Is Shown Above. This Firm Is One of the Largest in England Engaged in the Production of Cast Pipe. It Also Made Segments for the Mersey Tunnel

CONVEYORS Are Used to Carry Red Hot Castings Made in Centrifugal Molding Machines, as Shown Above, in the Foundry of the British Piston Ring Co. Ltd., Coventry. Left—View of No. 1 Foundry of the Metropolitan-Vickers Electrical Co. Ltd., Manchester

STEEL Car Wheels are Heat Treated in Continuous Annealing Ovens at Cammell Laird & Co. Ltd., Cyclops Works, Sheffield, as Illustrated Above. The Wheels Are Held in a Vertical Position on Trucks. This Allows Them To Come to a Uniform Temperature More Rapidly

A VIEW of the Foundry of the Austin Motor Co. Ltd., Longbridge Works, Birmingham, Is Shown Above. Converters May Be Seen at the Left. Left—All Large Machine Tool Castings Made by Alfred Herbert Ltd., Coventry, Are Produced in This Modern Foundry

Exhibitors at London Foundry Show

PRACTICALLY every type of foundry equipment used in the modern foundry will be shown at the International Foundry Trades exhibition which will be held at the Royal Agricultural hall, London, N.1, from June 5 to 15. The following represents a tenta-

H. WINTERTON

President, Foundry Trades Equipment & Supply Association

tive list of the manufacturers of equipment to be represented:

Allen, T. Fearnley & Son, 51 Norwich Union Chambers, Congreve street, Birmingham, England.

Allen-Liversidge, Ltd., Victoria Station House, London, S. W. 1, England.

Sir W. G. Armstrong Whitworth & Co. Ltd., Kinnaird House, Pall Mall East, London, England.

Atlas Preservative Co. Ltd., Windmill Lane wharf, Deptford, London, S. E. England.

Badische Maschinenfabrik u. Eisengiesserei, Durloch, Germany.

Alfred Baillot & Co., Saint Ouen-sur-Seine, Paris, France.

Beecroft & Partners, Ltd., Retort works, Mappin street, Sheffield, England.

Binders International Co., Ltd., 9 Albert place, Bridge street, Manchester, England.

Blackfriars Foundry Requisite Co., 34, Norfolk street, Strand, London, England.

Bradley & Foster, Ltd., Darlaston, blast furnaces, Darlaston, England.

Britannia Foundry Co. Ltd., Cox street, Coventry, England.

British Pig Irons, Ltd., Abbey House, Victoria street, London, S. W. 1, England.

Bureau of Information on Nickel, Ltd., 2 Metal Exchange building, London, E. C. 3, England.

Carborundum Co. Ltd., Trafford park Manchester, England.

The Louis Cassier Co., Ltd., 22 Henrietta street, London, W. C. 2, England.

Coleman Foundry Equipment Co. Ltd., 1 Lancaster place, London, W. C. 2 England.

David Colville & Sons, Ltd., 195 West George street, Glasgow, Scotland.

Consett Iron Co. Ltd., Consett Co. Durham, England.

Constructional Engineering Co. Ltd., Titan works, Charles Henry street, Birmingham, England.

J. B. Corrie & Co. Ltd., 15 Victoria street, London, S. W. 1. England.

William Cumming & Co., Ltd., Kelvinvale mills, Maryhill, Glasgow, Scotland.

Denbigh Engineering Co. Ltd., Horsley Heath, Tipton Staff, England.

J. & J. Dyson, Ltd., Fireclay works, Stannington, near Sheffield, England.

Fordath Engineering Co. Ltd., Hamblet works, West Bronwich, England.

The Foundry, Penton building, Cleveland, O., Caxton House, Westminster, London, S. W. 1. England.

General Refractories Co. Ltd., Wicker Arches, Sheffield, England.

E. Gernelle Danloy, 15 Rue Tous Vents, Rouen, France.

Grant & West Ltd., 17 South street, London, E. C. 2. England.

Thomas E. Gray & Co. Ltd., 119 High Holborn, London, W. C. 1. England.

W. T. Hawkins & Co., Chapel Hill, Huddersfield, England.

E. A. Herbert & Co. Ltd., 35 Summer Hill street, Birmingham, England.

Industrial Newspapers, Ltd., 49 Wellington street, London, W. C. 2. England.

Iron Trade Review, Penton building, Cleveland, Caxton House, Westminster, London, S. W. 1, England.

J. W. Jackman & Co. Ltd., Blackfriars road, Salford, Manchester, England.

Major, Robinson & Co. Ltd., 385 City road, Manchester, England.

Marley Hill Chemical Ltd., Milburn, House, Newcastle-on-Tyne, England.

Mastabar Belt Fastener Co., 14 Blackfriars street, Manchester, England.

Midland Sand Blast & Foundry Supplies, Ltd. Castle lane, Warwick, England.

W. T. Nicholson & Clipper Co. Ltd., Clipper works, King street, Salford, Manchester, England.

Ogilvy & Co., 20 Mortimer street, London, W. 1. England.

W. & C. Pantin, 147 Upper Thames street, London, E. C. 4. England.

J. Penicud & Co., 3 Rue Victor Hugo, Bagnolet, Seine, France.

Penton Publishing Co. Ltd., Caxton House, London, S. W. 1. England.

Pittevil & Co., 22-23 Laurence Poutney lane, London, E. C. 4. England.

Pneulec Machine Co., Ltd., Mafeking road, Smethwick, near Birmingham, England.

Pneumatic Engineering Co., Ltd., Oswaldestre House, Norfolk street London, W. C. 2. England.

Powell Duffryn Steam Coal Co., Ltd., 101 Leadenhall street, London, E. C. 3. England.

Rapid Magnetting Machine Co., Ltd., Magnet works, Lombard street, Birmingham, England.

Reavell & Co., Ltd., Ranelagh Works, Ipswich, England.

Rotary Air Compressor Co. Ltd., 12 Victoria street, London, S. W. 1. England.

T. E. Salter, Ltd., Bloomfield Road Engineering works, Tipton, England.

A. S. BEECH

Vice President, Foundry Trades Equipment & Supply Association

H. G. Sommerfield, Ltd., Charterhouse Chambers, Charterhouse square, London, E. C. 1. England.

Sperbolin, Ltd., Black Swan works, Halifax, England.

Sterling Foundry Specialties, Ltd., London road, Bedford, England.

Thomas & Bishop, Ltd., 37 Tabernacle street, London, E. C. 2. England.

Transporting Machinery & Engineering Co. Ltd., 76 Victoria street, London, S. W. 1. England.

Universal System of Machine Moulding & Machinery Co., Ltd., 13-15 Wilson street, London, E. C. 2. England.

A. Utard, Societe des Establissments, Longville en Barrois (Meux), France.

Rene Volet, Ltd., 242 Goswell road, London, E. C. 1. England.

Wadkin & Co., Green Lane works, Leicester, England.

Thos. Ward, Ltd., Albion works, Savile street, Sheffield, England.

Watsons, Ltd., Lancaster street, Sheffield.

Westoby & Rawstron, 326-327, Royal Exchange, Manchester, England.

Thomas Wilkinson & Co. Ltd., Stockton street, Middlesbrough, England.

Gustav Zimmerman, Dusseldorf-Rath, Germany.

June Meeting of A.S.T.M.
To Have Interesting Program

FOUNDRYMEN the world over are familiar with the American Society for Testing Materials through its work in establishing standard specifications, and standard methods of testing materials, and through the results of painstaking research investigations that are presented at its annual meetings. This year the society will hold its thirty-second annual meeting at the Chalfonte-Haddon Hall, Atlantic City, N. J., from June 24 to 28, and cast metals and alloys, nonferrous as well as ferrous, will receive considerable attention.

To this end the American Society for Testing Materials has arranged a symposium on cast iron at which a number of brief papers will be presented relating to classification and properties, correlation of test bar and casting, wear testing, machineability, corrosion. heat treatment, etc. A session will be devoted to nonferrous metals and alloys which will include reports of committees on nonferrous metals and alloys, high temperature and electrical resistance alloys, and light metals and alloys, cast and wrought. Two papers on aluminum alloys also will be presented. Another session on copper and copper alloys include with other papers of interest, the report of the committee on cast and wrought copper and copper alloys, and a paper on bearing bronzes.

Present Corrosion Data

Corrosion and fatigue of metals will be discussed at one session. That meeting will deal with both ferrous and nonferrous materials, and important contributions and reports of the society's activity in that field will be presented. Committee reports of interest to foundrymen will be those on corrosion of iron and steel, corrosion of nonferrous metals and alloys, and fatigue of metals. Papers on corrosion data of commercial steels, corrosion of metals under stress, and influence of corrosion accelerators and inhibitors on fatigue of ferrous metals also will be presented.

The session on steel and wrought iron will include reports of the committees on magnetic properties, on steel, joint committee on the investigation of the effect of phosphorus and sulphur in steel, ferroalloys, iron-chromium-nickel alloys, and the joint research committee on the effect of temperature on metal properties.

Fifteen sessions in all will be held during the five day meeting. The first will be the general opening session which will be held at 2 o'clock, June 25. G. W. Thompson, president of the American Society for Testing Materials, will open the meeting. This will be followed by the reading of the minutes of the previous meeting; report of the committee on papers and publications; report of the committee on standing committees; announcement of election of officers; introduction of new officers, and miscellaneous business. Nominations for officers are as follow: For president, T. D. Lynch, Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.; for vice president, F. O. Clements, General Motors Corp., Detroit, Mich.; for members of the executive committee, G. B. Haven, Massachusetts Institute of Technology, Cambridge, Mass., C. R. Hook, American Rolling Mills Co., Middletown, O., H. E. Smith, New York Central Lines, New York, and G. E. Warren, Portland Cement association, Chicago.

The second and third sessions will be held simultaneously immediately after the opening meeting. The second session will be on nomenclature, research and methods of testing. Committee reports to be presented are those on nomenclature and definitions, Cloyd M. Chapman, chairman; correlation of research, H. F. Moore, chairman; methods of testing, W. H. Fulweiler, chairman. Papers will be presented by E. C. Bingham; R. L. Templin and W. A. Slater. The third session on rubber, textiles, coal and timber will include the report of the committee on coal and coke, A. C. Fieldner, chairman.

Cast iron will feature the fourth session and to be held at 8 p. m. That meeting will include reports of committees on malleable castings, W. P. Putman, chairman; specifications for cast iron pipe, T. H. Wiggin. chairman; and cast iron, Hyman Bornstein, chairman. The symposium on cast iron will bring to the engineering profession the physical properties of cast iron. To lead the discussion, papers on various phases will be presented by J. W. Bolton, R. S. MacPherran, W. H. Rother and V. M. Mazurie, F. B. Coyle, J. T. MacKenzie, J. B. Kommers, Hyman Bornstein, A. L. Boegehold, E. J. Lowry and H. O. Forrest.

On Wednesday a session on steel and wrought iron will be held simultaneously with one on lime, gypsum, brick, refractories, tile, slate and building stone. The session on steel and wrought iron will include reports of committees on magnetic properties, Thomas Spooner, chairman; magnetic analysis, R. L. Sanford, chairman; steel, J. B. Young, chairman; joint committee on effect of phosphorus and sulphur on steel, G. K. Burgess, chairman; ferroalloys, N. B. Hoffman, chairman; iron-chromium-nickel alloys, Jerome Strauss, chairman, and the report of the joint committee on effect of temperature on the properties of metals, W. G. Saathoff, chairman.

Award Dudley Medal

The Edward Marburg lecture will be presented by Dr. Saul Dushman on Wednesday afternoon. His topic will be, "Nature of Cohesive Forces in Solids." At this time the Charles B. Dudley medal will be awarded to J. J. Kanter and L. W. Spring, both of the Crane Co., Chicago, for their paper, "Flow Test of Carbon Steels at Various Temperatures with Particular Reference to Stresses Below the Proportional Limit" which was presented at the 1928 meeting of the society. President W. G. Thompson will deliver his annual address at the Wednesday evening meeting. The address will be followed by the annual report of the executive committee, C. L. Warwick, secretary-treasurer.

A session on corrosion and fatigue of metals will be held Thursday morning when committee reports will be presented on corrosion of iron and steel, J. H. Gibboney, chairman; corrosion of nonferrous metals and alloys, T. S. Fuller, chairman, and fatigue of metals, H. F. Moore, chairman. Papers at this session will be presented by V. V. Kendall and E. S. Taylerson on "A Critical Study of A.S.T.M. Corrosion Data on Commercial Steels"; "Corrosion of Metals

(*Concluded on Page* 496)

Questions & Answers on FOUNDRY PRACTICE

THIS department covers all problems relating to metallurgical, melting and molding practice encountered in making steel, malleable-iron and gray-iron castings. Questions submitted by bonafide subscribers to this department will be answered by members of the editorial staff of The Foundry, supplemented where occasion requires by the advisory staff whose personnel is as follows:

John H. Hall—Steel Casting
H. A. Schwartz—Malleable Cast Iron
J. W. Bolton—Gray Cast Iron

All questions should be addressed to The Editor, The Foundry, Penton Building, Cleveland.

MALLEABLE

Has Steely Fracture

QUESTION

Under separate cover I am sending you a sample of malleable cast iron of approximate analysis before anneal as follows: Silicon, 0.73 per cent; manganese, 0.28 per cent; sulphur, 0.110 per cent; phosphorus, 0.12 per cent; and carbon, 3.45 per cent, made in a cupola furnace. We are aiming at black heart, but occasionally get metal as sample, having a steely gray crystalline fracture which is soft and machinable and has some degree of elongation but does not show the temper carbon in the fracture. We are annealing at 870 degrees Cent. for 80 hours with a packing of sand and pot scale. Some of the castings in the same anneal come out black heart and others as sample. Occasionally the whole anneal comes out white.

The cupola is bricked to 27 inches in diameter and the charges consist of 180 pounds of pig iron analyzing, silicon, 1.33 per cent; manganese, 0.88 per cent; sulphur, 0.045 per cent; and phosphorus, 0.12 per cent with 120 pounds of mild steel scrap. The whole charge is tapped into a 300-pound receiving ladle and then poured into the molds from double-shank 75-pound ladles. The coke is of the following analysis: Ash, 7.58 per cent; moisture, 2.33 per cent; fixed carbon, 89.3 per cent; and sulphur, 0.89 per cent. Weight of coke to iron 1 to 6.

Is it necessary to add continually new scale to the packing material? Should some of the steel be cut out and the silicon lowered by using low silicon pig? What should be the limit of the steel? Should there be a balance between the sulphur and the manganese? If so which should predominate, and to what extent? What should be the absolute limit of the sulphur and manganese even when in balance? We pick up about 0.04 per cent of sulphur in the anneal. Is this detrimental? Can you give us a specification for a pig iron suitable for cupola malleable?

We have made experiments of using all return scrap, that is runners, wasters, etc., and desulphurized in the ladle by means of soda ash and adding manganese, finally obtaining an analysis in the casting of: Silicon, 0.75 per cent; manganese, 0.27 per cent; sulphur, 0.094 per cent; and carbon, 3.38 per cent, but this material absolutely refused to anneal, although annealed twice at 900 degrees Cent. What is the reason?

ANSWER

Probably the best method will be to answer your questions first and then discuss the matter in detail.

Packing material may be revivified by the addition of new scale from time to time. However, in some shops just lime or sand is used for packing and good results claimed for its use. Many claim that it is not necessary to have any packing material whatsoever. They use the packing material only to support small or intricate castings that would warp or bend when heat treated. An active packing sometimes causes penetration of oxides into the casting and causes the fracture to which you refer.

It appears that the amount of steel used in your charge is much too high. From 10 to 20 per cent is the limit. The silicon in the charge can be balanced by the use of some low silicon pig iron. Examine your steel scrap for chromium. If it is present it may cause trouble in the annealing.

Sulphur has the tendency to cause the cracking of the white castings. It also causes trouble in annealing and reduces strength. Some malleable makers claim that they have obtained excellent castings with sulphur as high as 0.20 per cent without experiencing any trouble in annealing or otherwise. Manganese over 0.6 per cent renders castings hard to machine and causes trouble in the anneal. The manganese should be at least three times the sulphur, and we suggest that you increase your manganese to 0.30 to 0.35 per cent.

A pick-up of 0.04 per cent sulphur in annealing seems to be a little high. Generally the pick-up is not over 0.03 per cent. Watch your packing and see that the pots are mudded or sealed tightly before putting in the oven.

The sample sent to us appears to be burnt or over annealed. Perhaps the reason for certain portions of the heat turning out in this manner may be due to a poor mixing of the large amount of steel in the heat. You do not state whether the castings that have this fracture are from pots at the front or back of the oven, or from the top or bottom of the stack. If the castings appear in the portion of the furnace that is the hottest, they are over annealed. We are of the opinion also that the period of holding is too long and suggest shortening the period from 80 hours at 870 degrees Cent. to 72 hours. Possibly the time may be shortened more, but that will be determined by the results obtained. An important point to watch is the cooling period. During cooling, the temperature drop should not be more than 5 to 10 degrees per hour until the critical range is passed. This value may range from 1310 to 1375 degrees Cent.

You will need some leeway in pig iron silicon content that you may

adjust your charges to suit conditions, hence it is best to have pig with varying amounts of silicon. We would set the lower limit around 1.00 per cent and the upper at 1.50 per cent. Sulphur should be 0.05 per cent maximum; manganese, 0.40 to 0.60 per cent; and phosphorus 0.15 to 0.225 per cent.

As a general rule return scrap is mixed with pig iron in the charges, and we have no data on the use of all return scrap to indicate why the anneal failed. There are many factors that enter into the correct annealing of malleable cast iron such as the silicon content, the manganese content, and the sulphur content. An off sulphur-manganese ratio or some other difficulty not apparent on the surface may cause the trouble you have. There is also the possibility of rusty or burnt scrap. Since there is no new pig used, the tendency of burnt scrap to create trouble is magnified. Our first suggestion is to try much higher annealing temperatures, say from 950 to 1000 degrees because at times the combined carbon requires exceptionally high temperatures to change it to the temper carbon. Another suggestion is to increase the silicon to about 1.00 per cent. We believe that this iron from an all scrap mixture would be excellent for annealing pot mixture.

In thin castings, say up to ¼-inch in thickness, the silicon may be from 1.00 to 1.20 per cent and still obtain white castings. As the castings become thicker in section the silicon should be lowered, otherwise mottled and sometimes gray castings will result. Therefore in ½-inch section castings the silicon may vary from 0.45 to 0.75 per cent or with higher silicon, graphite precipitation may be prevented by using chills.

The analysis of your coke shows up well, especially if it is fairly hard in texture. Soft coke breaks up into breeze easily and fails to stand the burden of the charge and tends to bung up the cupola.

Your practice of using a mixing ladle before the hand ladles is good. You do not state whether the tap hole is open continuously. You will find that by having continuous operation that the iron will be much hotter. You may have to use a larger mixing ladle to maintain a sort of a reservoir for the molten iron.

We assume that you are using pyrometers in your annealing operation. Do you put them into the pots in various positions in the furnace? If not, you should do so that you may have better control of the annealing operation. Also there is a decided lag between furnace temperature and that in the annealing pots. A good way to check up on the time required for the holding period is as follows: Place bars of the same analysis in the front of the oven where they may be removed at any time. These bars are to be packed with the regular material. A brick or two may be arranged in the oven door to make the bars accessible. After the oven reaches the required temperature, the bars are removed at stated intervals and the bars tested when cold. Five bars could be used and removed at the elapse of 60 hours, 66 hours, 72 hours, 76 hours, and 80 hours. This method would give you some idea as to the proper length of the annealing period and prevent any over annealing.

GRAY IRON

Makes Car Wheels

QUESTION

We are interested in receiving information on the best foundry practice for making cast iron car wheels, particularly in the mixtures used. We have had some difficulty in the past with wheels cracking on the chilled tread and would like any information on the subject.

ANSWER

There are slight variations in the analyses for railroad car wheels and those of mine cars as shown in the following typical analyses:

	Railroad Per Cent	Mine Car Per Cent
Silicon	0.45 -0.70	0.75-0.85
Sulphur	0.110-0.140	under 0.095
Phosphorus	0.20 -0.40	0.20-0.40
Manganese	0.40 -0.80	0.60-0.80

Higher silicon in the mine wheels is necessary because of the smaller size of wheel. Lower sulphur is specified in the case of mine car wheels as the manufacturers believe that sulphur causes red shortness and trouble if the wheels become overheated in braking.

Some foundrymen use several brands of pig iron in the charge as they claim a better product results, and in some foundries as much as 25 per cent of charcoal iron is placed in the charge. Steel often is used to aid in lowering the silicon and carbon and runs from 5 to 10 per cent. Manufacturers of railroad car wheels use as high as 60 to 70 per cent scrap car wheels in the charge. To assist in sulphur removal and add strength to the metal ½ to 3 pounds of pea-size ferromanganese are added to the ladle as the iron is poured in.

As soon as the castings are shaken from the sand, they should be placed in an annealing pit and allowed to remain from 3 to 5 days. The pit must be preheated by wood, oil or gas for the first charge. The hot wheels later furnish their own annealing heat. Annealing the wheels relieves any strains that may be present.

Q & A

Have Good Results

QUESTION

We are making stove castings, furnace castings and light implement castings. Our average analysis is: Silicon, 2.27 per cent; sulphur, 0.075 per cent; manganese, 0.51 per cent; phosphorus, 0.54 per cent; graphitic carbon, 3.09 per cent, and combined carbon, 0.34 per cent. The iron seems pretty good to us, but would like to know if any improvement could be made.

ANSWER

Your question answers itself when you state that the iron seems pretty good to you. Since the metal gives good castings without any difficulty encountered in drilling, you need not worry. Stove castings are thin and the silicon should be high to prevent hard castings. The range generally given is from 2.25 to 2.75 per cent. The fact that your silicon is on the low side should cause no concern as long as the iron remains soft enough. Should the iron become hard, it will be a sign that the silicon should be increased.

Analyses by themselves will not always tell the story. Another foundry making the same product may find that your analysis will not work well because it is using more or less scrap, etc. Consequently, the chemical analysis is used as a guide post rather than an exact value that must be adhered to. By experimenting you can determine the allowable variations, and then hold your analysis between the two extremes.

GENERAL

Gives Metal Shrinkages

QUESTION

To what extent will a cast iron bar or a lead bar 1 inch in diameter and 12 inches in length shrink in cooling?

ANSWER

A cast iron bar 1-inch diameter and 12 inches in length will contract ⅛-inch in cooling. A lead bar of the same dimension will contract 5/16-inch. This is regarded as normal contraction for these metals and obtains irrespective of the size, provided the mold or cores do not prevent the metal from following its natural course.

For example in small cylinders the contraction allowance for iron will only be 1/16-inch; on iron pipe ⅛-inch; on long girders etc., 1/64-inch. The contraction on the upper end of a large cylinder may be ⅝-inch, while the contraction on the lower end of the same cylinder may not exceed

5/64-inch. The shrinkage in length usually is 3/32-inch. The foregoing figures refer the contraction per foot.

Patternmakers use standard rules on which the contraction feature of various metals has been worked out. Thus the rule employed in measuring a pattern for an iron casting made with graduations that aggregate 12⅛ inches, or, as it generally is expressed ⅛-inch to the foot. For aluminum castings the rule is 11/64-inch, for steel ¼-inch and for lead 5/16-inch.

Q & A

Capacity Seems Low

QUESTION

Some time ago we saw a description of a method using a thermocouple to obtain the relative heat of the molten iron emerging continuously from the cupola. We equipped our cupola in the same manner and used it for 40 days without any marked degree of success due to the fact that we only pour about 18,000 to 20,000 pounds of iron a day. The cupola has a 63-inch shell and does not seem to have a melting rate sufficient to keep a good stream of iron coming down the spout. Consequently we are troubled with cold iron.

ANSWER

Information you give leaves much to guess but it appears that if your cupola has a 63-inch shell it must be bricked with a much thicker lining than ordinarily is the case because a cupola of this size should melt from 7 to 9 tons per hour. This is assuming that you are melting continuously at about 1 to 2 tons an hour.

If this is the case and the fan or blower that you have, was supplied to give the proper air-blast to operate this cupola (7 to 9 tons per hour), there is no doubt that your air volume is much too great at the present time. A close approximation which may be used in figuring air volume is that one pound of 88 per cent carbon coke requires 2.34 pounds of oxygen or 10.13 pounds of air to burn it completely to carbon dioxide Since air weighs about 0.074 pounds per cubic foot at 70 degrees Fahr., a pound of the coke will require 136.8 cubic feet of air.

Two hundred pounds of coke will melt a ton of iron, therefore putting it in terms or air, 27,760 cubic feet of air will melt a ton of iron. However, to have hot iron about 250 pounds of coke should be used per ton of iron Consequently, the amount of air would be raised to 34,300 cubic feet. Now if the original fan for your cupola supplied air to melt 8 tons an hour, would supply 274,400 cubic feet per hour. However, at the present time you are only melting 2 tons an hour and requires 68,600 cubic feet or one-fourth. Therefore, your fan or blower should be slowed down or replaced by one of the proper size to meet the present condition.

The previous calculations and assumptions are based on the premise that the cupola is a large one that has been lined down, that the fan was for the original installation and you are operating continuously. You may check the size of pour cupola by the fact that a cupola with a 63-inch shell ordinarily has an inside diameter of 45 inches as originally supplied for melting 7 to 9 tons per hour. Data on the fan or blower would have to be obtained from the manufacturer. Another way to check the air would be to examine the cupola interior before patching. The melting zone should not be over 12 inches wide and located a short distance above the tuyeres. If it is wide and way above the tuyeres, your blast is too high and should be cut.

Your coke bed should be from 24 to 30 inches high. The best way to determine the proper height is to watch the first iron after the cupola is well-lighted and the blast turned on. The first iron should appear in 8 to 10 minutes. If shorter time is taken, increase the bed height; if longer, reduce the bed a few inches. Perhaps you might be able to increase the heat of your iron by using 1000-pound iron charges with 125 or 130 pound coke splits.

As stated in the beginning, these suggestions are a shot in the dark, as we do not have sufficient information on your operating conditions.

STEEL

Should Resist Acid

QUESTION

One of our customers recently asked what would be the best alloy steel castings to use for valves and fittings in a pulp mill. The customer suggested high chromium steel but we understand that chromium steel will resist nitric acid but not sulphuric or sulphurous acids. What alloy would you recommend for this purpose?

ANSWER

Your information on the resistance of chromium steels to nitric acid is correct. High chromium steels do not seem to resist sulphuric acid or sulphates so well. However, it is claimed that nickel additions to chromium steel will aid in resistance to sulphuric acid. Most of these alloys are patented. One used for mine pumps which generally contains sulphates and sulphuric acid is a nickel-chromium alloy. This alloy contains 60 per cent nickel and 12 per cent chromium. Another alloy for the same purpose contains 25 per cent chromium only with low carbon content. A German alloy developed by Krupp contains carbon, 0.25 per cent; chromium, 20 per cent and nickel, 7 per cent. This is recommended for acid pumps, valves of all kinds, beater blades, plunger pistons, piston rods and a number of other corrosion resisting parts.

Generally, for sulphite pulp work bronze is suggested. Probably the regular 90 copper-10 tin is most used for this purpose. The 87 copper-13 tin also is used.

Q & A

Steel Not Cupola Product

QUESTION

We have a lot of steel scrap left in making heads for blue annealed steel tanks averaging No. 14 gage. We have several requests for steel castings and understand that steel foundrymen make castings from this kind of scrap. We have been told we could, also we could not, melt this steel in an ordinary cupola which we are using. Any information you can give us on procedure, possibilities, etc., will be greatly appreciated.

ANSWER

If you want to make steel castings you will have to install one of four types of steel melting units: An open hearth furnace, a converter, a crucible furnace or an electric furnace. Sheet steel scrap may be melted in the cupola, but the resulting metal will not be steel. It will be a species of gray cast iron, the variety depending on the amount and character of other elements added during or immediately following the melting process. If the steel is melted alone the resulting product will be a white cast iron, extremely hard and brittle.

The reason for this is metallurgical. Thin sheet steel only has a carbon content of 0.20 per cent. Iron from which steel is made has a potential absorption capacity of over 4.00 per cent carbon. When steel scrap is melted in a cupola in direct contact with coke nothing on earth can prevent it from absorbing carbon up to 2.50 or 3.00 per cent, and metal with a carbon content of that kind no longer is steel.

Unless you have a considerable demand for steel castings, or unless you feel that you can develop a market for a considerable tonnage, you could not install steel melting equipment and make it pay. Approximately 10 per cent of your cupola charges for present gray iron requirements may be made up from the steel clippings. This will dispose of a certain amount. The remainder had better be sold to a scrap dealer or to any other interest which may be in the market for this kind of material.

Problems in Nonferrous Founding

By Charles Vickers

Must Be Well Coated

We experience difficulty making cores for brass bars 13 inches long and 5 inches diameter. The cores are 1 inch in diameter, and the metal burns into them in such a way that we have a hard time getting them out of the casting. The core wires will not come out. The castings are poured upright and gated at the bottom.

The cores need a thick coating of plumbago as simply painting them with a thin wash of plumbago is not good practice. Make the plumbago into a soft dough using molasses water, or water glass solution and use the best grade of foundry plumbago obtainable. After the cores are dried, put some of this paste on the inside of the index finger. Scrape this finger along the core thus rubbing on a thin and uniform coating of polished plumbago. Afterwards rub the core with the palm of the hand and polish it like a stove. Such a core will never permit the metal to enter its pores. If it does, then the job has not been done right.

It is not necessary to pour such castings with hot metal. For example, 2250 degrees Fahr. is entirely too hot, especially if the metal contains phosphorus. Strike a happy medium, something like 2100 degrees or even 50 degrees lower. Make the cores of silica or other good sharp sand, bonded with oil preferably. However, other binders also are good.

Q & A

Melting Is at Fault

We are making bushings for motor bearings, from 1½ to 3½ inches in diameter, ½-inch metal wall and from 8 to 13 inches long. We have had a lot of trouble lately due to gas holes. We use a mixture of 83.5 per cent copper; 8 per cent tin; 8 per cent lead and 0.5 per cent phosphor-tin. We use crucibles in oil-fired furnaces. The copper is melted under charcoal, the phosphor-tin added then the tin and the lead in the order named. We leave it in 10 minutes with the fire going. We have tried omitting the lead when the tin is added in the furnace, adding the lead finally when the pot is drawn, with no improvement in results. We cool off the metal with gates of the same mixture. The castings are molded on end and are vented all around and we have tried both top and bottom gating without changing the result. We feel sure the source of the trouble is in the melting. We use copper wire mostly in the charge.

There is nothing that we can criticize about the melting practice, or the manner of alloying the metal, neither is the gating or method of making the molds particularly wrong. It all reads like common ordinary practice which gives good results in making castings, but it is evident there is some little thing out of joint, otherwise, where do the holes come from? There are only a few ways in which holes can be produced in castings, and two of them are gassed metal and impervious molds.

We will deal with the first named source of *cheesey* castings. When a 200-pound pot of metal is pulled in around 35 minutes or so, spongy castings have been the result of covering the metal in melting. If that is the melting time, try the next heat minus the charcoal. There is a difference in the results obtained from melting in a coke-hole and melting in an oil or gas-fired furnace of high temperature. Without the charcoal the metal will be no worse than it is at present, but if the melting time is longer than the period named, we would still discard the charcoal in the oil-fired furnace, but replace it with a small amount of common bottle glass, just enough to film over the bath of metal. Also 0.5 per cent phosphor tin is not sufficient to do much good in the case of the alloy named, although 0.5 per cent phosphor tin is sufficient for ordinary red metals and steam metals. The alloy given will stand 2 per cent of phosphor tin, and we suggest that amount be used.

Be careful in adjusting the flame! If it smokes the heat will be gassed, and will be in the furnace entirely too long. If it is a fierce and brilliant white and green the metal will be gassed. Strike a happy medium, which must be discovered on each individual furnace as a rule. There must be neither too much or too little oil used, as both with produce porous castings. A moderately oxidizing flame does the work of melting satisfactorily, especially if the molten surface of the metal is covered with a *thin* film of slag, such as produced by molten glass, or any of the fluxes advertised in the pages of THE FOUNDRY. In fact, such fluxes are intended to protect the metal from the injurious gases present in the furnace during the melting period. Charcoal does not appear to fill the bill in oil-fired furnaces. It blows away and leaves the surface uncovered, and while, as mentioned with rapid melting, cases are known where the best results have been obtained without covering of any kind on the metal, as a rule a thin covering of some suitable flux gives consistently good results.

Q & A

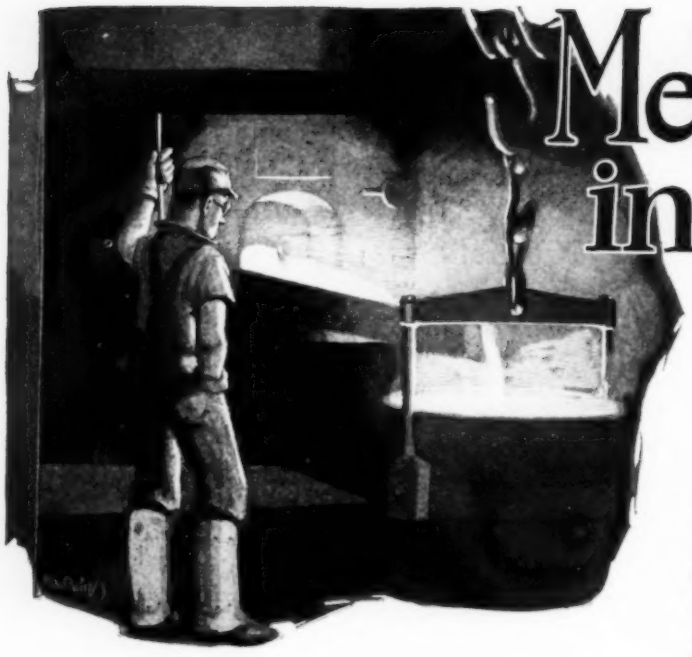
Wants Bronze Alloys

We would like you to advise us what is the best alloy to use for a bronze sign on building exteriors. Also, we are interested in an alloy for bronze hardware fittings, and also a yellow brass mixture. All these alloys have to be polished.

For bronze signs use an alloy containing 90 per cent copper; 6 per cent tin; 2½ per cent zinc and 1½ per cent of lead.

For hardware fittings use either of the following alloys: (1) Cheap—copper, 84 per cent; zinc, 10 per cent; tin, 3 per cent, and lead, 2 per cent; (2) copper, 88 per cent; tin, 8 per cent; zinc, 2 per cent, and lead, 2 per cent. The bronze sign mixture also is quite suitable for the hardware fittings.

For a good yellow brass that can and should be cast without addition of aluminum, use: Copper, 75 per cent; zinc, 22 per cent; tin, 2 per cent, and lead, 1 per cent. A second choice is copper, 77 per cent; zinc, 18 per cent; tin, 3 per cent, and lead, 2 per cent.



Melting Iron in the Cupola

By J.E.Hurst

Part XIX

MAINTAINANCE cost of cupola firebrick linings may be reduced considerably by using cast iron bricks in the region around and below the charging door. At that point, particularly with certain forms of mechanical charging devices, repeated shocks, cause rapid disintegration of brickwork. Cast iron bricks easily are made and may be set in position in a manner exactly similar to ordinary bricks. Diagrams of various forms are shown in Fig. 125. The form illustrated in the upper left is preferable to others. It is molded easily and it can be filled readily with loose firebrick and fireclay. The iron bricks are built completely around the inside of the cupola at and below the charging door level. The structure should be supported on a suitable cast iron or steel angle ring, bolted to the cupola shell. Usually the iron bricks are built down to a depth of 2 feet from the charging door level. A greater depth can be used with advantage and the author's own cupolas are lined to depth of 4 feet.

Firebrick linings in foundry cupolas fail after continued operation as a result of slag erosion, chemical action with the slag forming materials and erosion and shock to which the lining is subjected by the heavy metal portions of the charge. Failure takes place at the brickwork joints made of fireclay. Life of the lining is prolonged by the use of large bricks or cupola blocks, which reduce the number of joints in the structure. Considerable erosion takes place each time the cupola is used. The brickwork is scored most in and about the region of highest temperature or melting zone, and must be patched after each heat with ganister.

Ganister is a highly siliceous clay which resists satisfactorily the high temperatures involved, and also the chemical action of the slag and slag forming materials in the cupola. Unfortunately the bonding power of ganister alone is low, due to its high silica and low clay content. Ganister is improved by the addition of a small quantity of lime which under the influence of heat forms a glass like calcium silicate and helps to frit together and consolidate the ganister into a hard, solid, stony mass. This practice is followed in lining crucible furnaces. Rammed ganister or silica rock with 2 per cent lime addition has been recommended for long life cupola lining. Bonding power of ganister is improved considerably by milling, although it is claimed that excessive milling tends to reduce its refractoriness. Refractoriness of ganister is improved by the sizeable particles of practically pure silica which exist in the partially broken down material.

Although ganister is a natural product, it can be imitated satisfactorily by synthetic mixtures. As long ago as 1885, Bloxam states that a fairly good substitute for ganister can be made from powdered pure siliceous stone mixed with a certain amount of aluminous clay. Natural ganisters frequently are "improved" for cupola purposes by the admixture of an additional amount of clay. A typical mixture recommended for cupola purposes follows:

	Per Cent
Ganister	40
Crushed old firebrick	40
Coke breeze	10
Fireclay	10

This mixture should be turned over in a pugmill for 10 minutes. It resembles the old time "brasque" mixtures in which coke dust or charcoal debris was added to better resist the action of corrosive slags. Another simple recommended mixture consists of equal parts of firebrick, fireclay and silica sand. These mixtures should be prepared fully 24 hours before they are used.

Natural ganister in England is a siliceous rock underlying the coal deposits of South West Yorkshire, North Derbyshire, South Lancashire and Cleveland district. The sedimentary rock is densely hard and contains silica up to 98 per cent. Ganister derives its refractory properties from this high silica content. For cupola purposes, ganister should not contain

Compare Linings

IN MANY instances a cast iron brick lining has served to cut down expense in cupola maintenance. The hollow cast iron blocks take the place of the regular lining brick and extend downward from the charging door for a distance varying between 2 and 4 feet. This type of lining particularly in that area is designed primarily to resist abrasion from the falling stock. Fireclay joints between the fire bricks constitute the first lines of attack and for that reason a one-piece lining presents certain advantages. For the same reason special blocks of comparatively large size and conforming to the circle of the cupola will outlast the ordinary fire brick lining.

less than 92 per cent silica. Bonding power usually is improved by the admixture of fireclay which should not exceed 15 per cent.

Many other siliceous materials are used for patching, including a mixture of equal parts carborundum, fireclay and ground crucibles. Fire sand and fireclay in varying proportions are used extensively in American foundry cupolas. Use of materials in any given district ultimately is determined by the cost.

Extensive patching required in brick lined cupolas has received a great deal of attention. Common knowledge that weakness of the brick lining lies in fireclay joints has been referred to previously. Present tendency seems toward a reversion to monolithic lining. This tendency is due to some extent, particularly in this country, to discovery of various more or less siliceous clays which possess the necessary bonding power and necessary degree of refractoriness for the purpose.

Ram the Lining

Origin of monolithic linings dates back to remote antiquity. Modern use of these linings probably originated on the continent and certainly has been more common on the continent than in this country. Some of the continental products have been exported for this same purpose.

In practice, the lining material generally is supplied in the milled condition practically ready for ramming into position. Suppliers usually advise that the material is improved by standing for a few days. The material should be as dry as possible, and still sufficiently plastic to be rammed. A wood plug or a metal liner ring corresponding in size to the internal diameter of the cupola is mounted centrally in position at the hearth level. The plastic material is introduced into the annular space between this plug and the cupola shell and rammed hard and solid into position. The plug is pulled upward a few inches at a time until the shell is lined completely. The lining material is rammed with flat rammers heated to prevent sticking.

Drying of this dense, hard rammed lining requires considerable care and attention. All moisture from the plastic mass must be expelled through the mass itself. To facilitate this passage, the solid lining should be vented carefully by a stout wire rod pushed completely through the radial thickness of the lining. The thicker the lining the more venting is required, and it may be considered as axiomatic, that venting cannot be overdone. Wisdom of using the plastic material in the dryest possible condition in which it can be rammed will be appreciated. This feature reduces the total amount of shrinkage of the lining on drying, a desirable feature in maintaining the strength and ultimately the life of such a lining. Following the venting process the lining should be dried carefully by a slow fire. After the lining is thoroughly dried, it is advisable to increase the intensity of the firing to the possible obtainable maximum.

Plastic materials used for monolithic linings consist essentially of silica and clay. Ultimate rigidity of the lining is determined by a well known characteristic of clay. At a sufficiently high temperature it becomes converted into a hard, more or less stony mass, as in bricks. The aim in making a monolithic lining should be to obtain a one piece lining with all the characteristics of brick.

In the usual rammed monolithic lining complete burning of the material is presumed to take place during the actual melting period. Effect of normal cupola operation in this direction presents a feature of considerable interest. Burning of clays in brick making takes place in two stages: The initial stage, in which the included water is driven off, and the final stage in which the combined water is eliminated and the clay converted into the hard form. The final stage also is carried out at a sufficiently high temperature to obtain a complete fritting together of the various constituents to yield a brick of the desired hardness and mechanical strength. This temperature is determined principally by the character of the brick material and is higher in silica bricks than firebricks. The temperature in silica brick kilns is between cones Nos. 14 and 15, about 1450 degrees Cent.

Temperature conditions vary considerably in the thickness of cupola linings. A series of temperature determinations of the inside and outside surfaces of the cupola lining in different zones has been obtained by Piwowarsky and Broglio. These results are given in Table XXVI.

Correct burning temperature of monolithic lining plastic refractories which usually contain not less than 84 per cent silica is not as high as that required for silica bricks. For practical purposes it may be considered approximately 1000 degrees Cent. Correct burning temperature is defined as that used to obtain bricks of the necessary refractoriness and mechanical strength for cupola practice. Temperature on the outside of the lining and in the throat zone is not high enough to obtain proper burning conditions.

Temperature distribution burns the monolithic lining material to brick hardness on the inside surface at the bottom, melting and middle zones. At the back of these zones and in the throat zone the material may be improperly burnt and is therefore mechanically weak. At the throat zone the temperature is hardly high enough to drive off the included moisture. Material at these points therefore may be mechanically weak. Obviously this is undesirable where the lining is subjected continually to shocks from charging heavy materials. Unfortunately the mechanical weakness is greatest in the throat zone where the lining sustains the maximum shock due to charging.

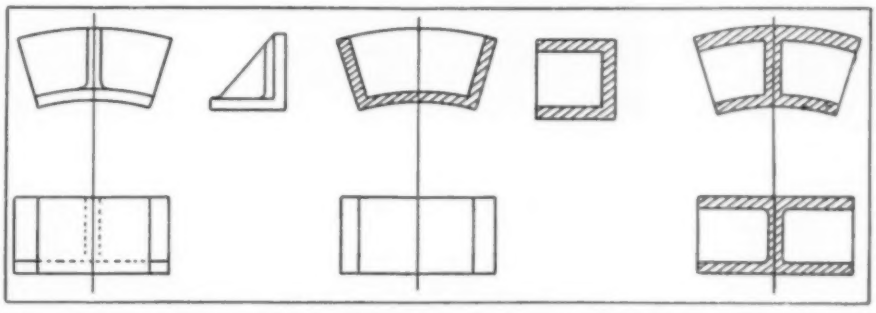


FIG. 125—VARIOUS SHAPED HOLLOW CAST IRON BLOCKS HAVE BEEN PLACED IN SERVICE IN THE CUPOLA LINING

Various suggestions have been made, and some patented for improving the mechanical strength in the interior of monolithic linings. These suggestions generally involve the use of some type of reinforcement.

A row of ¼-inch diameter steel rods bent at right angles and spot welded to the furnace casing has been recommended for the monolithic linings of rotary heat treating furnaces. Various types of metallic reinforcement involving the use of steel bars or cast iron frames also have been suggested. The cupola referred to in the research by Piwowarsky and Broglio was lined with iron-armored silica paste. Interesting description of reinforcement applied to a dolo-

mite lined cupola comes from Germany. The lining, a dolomite and tar mixture, is reinforced with steel turnings. The mixture is spread to a thickness of 3 to 8 millimeters (approximately ⅛ to ⅜-inch). A layer of steel turnings is applied, followed by successive layers of mixture and turnings, until the complete thickness is obtained.

Addition of comparatively large sized silica rock aggregate embedded in the plastic material, is common in England for reinforcing the lining as a whole. However, none of these methods will prevent the mechanical weakness of the lining in the throat zone in the neighborhood of the charging door. The only effective method for overcoming this difficulty is to use iron bricks from the charging door downward. Precaution should be taken to suitably support the iron bricks by a ring inside the cupola shell. An iron brick lining in the throat zone properly and independently supported and a monolithic lining carefully prepared and preferably reinforced by comparatively large sized aggregate, constitutes a highly satisfactory cupola lining which will compare favorably with the usual brick lining.

Silica bricks are not used for cupola linings. They are acid in character and deteriorate rapidly under influence of limestone flux. Bauxite bricks are made from an aluminous clay varying somewhat in composition between the following limits:

	Per cent
SiO_2	13-17
Al_2O_3	60-65
Fe_2O_3	4- 8
Comb: H_2O	15-17

Bauxite bricks do not possess any superiority over fireclay bricks to warrant their use in cupola linings.

Sillimannite variously known as cyanite (kyanite) or andalusite, an alunimum silicate composition Al_2O_3, SiO_2 containing about 37 per cent SiO_2 and 63 per cent Al_2O_3 has attracted considerable attention during recent years as a substitute for fireclay refractories. Some of the principal deposits of this material are found in India. The commercial material has an aluminum silicate content of 90 to 98 per cent, a melting point of about 1816 degrees Cent., a low thermal expansion uniform up to high temperatures is neutral in chemical reaction and the coefficient of linear expansion from 20 to 1000 degrees Cent. is 0.0000056.

Chromite bricks made from chrome ironstone are chemically neutral. Typical composition of this material follows:

	Per cent
Chromic oxide	42.0-60
Ferrous oxide	15.0-20
Alumina	15.0-16
Magnesia	15.0- 1.5
Lime	1.0- 0.5
Silica	7.0- 2.0
Water and organic matter	5.0- 2.0

Kieselguhr appears under various names including diatomite and celite, and is diatomaceous earth resulting from the decomposition of tiny microorganisms, diatoms, which once existed in the ocean bed. It is highly siliceous in character, light in weight, composed of numerous tiny cells and has a high refractory and insulating power. The material is made up into bricks and finds extensive use where heat insulation is required. Kieselguhr has a thermal insulating power about equal to that of cork and a melting point of 1610 degrees Cent.

TABLE XXVI

Cupola Temperatures

	Temperature Degrees Cent. I. D.	Temperature Degrees Cent. O. D.
Bottom zone	1550	143
Melting zone	1700	132
Middle zone	1300	130
Throat zone	850	75

Care Needed in Selecting Wire Rope

By Walter Voightlander

WIRE rope, as applied to shop cranes and electric hoists, frequently is subjected to severe usage and not uncommonly to excessive overloads. Since it is necessary to swing loads over workmen and all floor equipment, the safety factor is a consideration of first importance.

According to the American Cable Co., Chicago, ordinary shop cranes and hoists employ one of three types of wire rope, composed of six strands with 19 wires to the strand, six strands with 37 wires to the strand or eight strands with 19 wires to the strand. Plow or improved plow steel usually is used. Drums and sheaves should have diameters not less than 30, and 20 times the rope diameters. When in service on skull crackers, strippers, bridge cranes or other equipment handling capacity loads continuously, wire rope should be of the 6 x 37 construction and the factor of safety no lower than seven. That is to say: The rated capacity of the hoist or crane should not cause a stress in the rope of more than 1/7 of the actual tensile strength of the rope.

Ropes on ladle or hot metal cranes more or less are subjected constantly to high heat and all such ropes should be supplied, in construction, with a wire rope center. Subjection to considerable heat will char the hemp center of ordinary rope with greatly reduced rope life and safety to workers as the result. The factor of safety on these ropes usually is eight as a minimum, the minimum drum and sheave diameters 30 times the rope diameter, and the rope service limited to periods ranging from nine to 15 months.

Theoretically, equalizing or compensating sheaves may not be considered as an operating sheave. However, actually, there is a movement of the rope over such sheaves and it must be admitted that nearly any movement will naturally set up wear or have abrasive tendencies. Rigid inspection should be made of the underside of the rope bearing on equalized.

All sheaves and drum grooves should be inspected frequently for wear, as a worn sheave tread can do great damage to a rope. At the time rope replacement is made, strict adherence to rope size and sheave fit must be made the rule if proper rope service is expected or desired.

Another factor frequently responsible for early rope failure is lack of proper lubrication. Practically all the cores of good brands of wire rope are thoroughly impregnated with a commercial, chemically-neutral rope oil. While the core retains a liberal supply of this lubricant which gradually oozes out as the rope is used, still, frequent application of a good lubricant during service is necessary to prevent the core becoming dry and absorbing moisure which will set up corrosion of the inner wires, or the outer wires from losing their film of oil. A rather thick, semiplastic compound applied while hot and in a thinned condition is a good lubricant for hoist and shop crane ropes. In its heated state it will penetrate after which, when cool, will constitute a plastic filler that will act in the dual capacity as a preservant and lubricant.

Make Marine Engine Castings

Gray Iron Shop Operated on a Co-operative Basis Builds Addition To Care for Increased Demand for Gray Iron Castings

By Pat Dwyer

RECENT erection in Cleveland of an addition to accommodate 16 molders marks the tenth anniversary of the establishment of a jobbing gray iron foundry by a group of skilled molders accustomed for many years to handle intricate and difficult castings made for utilization both in and out of the Cleveland industrial field. Other additions are in contemplation and when finished will justify the faith of men who gambled on a business venture without any previous training or experience in that field. They were long on technical skill, but short on cash and on the technique of selling castings to yield a profit.

The venture, like nearly all ventures, has had its ups and downs. The tidal wave of increased business in all lines, practically had reached the limit of its flow in 1919, the year following the cessation of official war activities. The new foundry was rushed to completion in the latter part of that year. The owners helped to build it. Not figuratively, but literally. They staged no jurisdictional fights over who should do this and who should do that. On the contrary they staged a beautiful—and in this modern age all too rare—demonstration of the Biblical plea: What thy hand findeth to do, do with all thy might.

Early in 1920 the foundry was completed and placed in production under the title "The Cuyahoga Foundry." The name is the same as that of the narrow, crooked river which flows through that part of Cleveland known as the Flats, one of the main industrial sections. The original inhabitants of the country, the Indians, knew the river by this name and the early white settlers of this—at that time—far western land, paid them the delicate compliment of retaining the name. In the succeeding years the name became adopted widely in the district as the name of the county, a village on the outskirts of Cleveland, and a great number of buildings, public and private institutions and enterprises of many kinds.

The word *cuyahoga* seems to present formidable difficulty to the ordinary English reading or speaking person, but like many other apparently impossible foreign words, it lends itself quite readily to pronunciation as a four-syllable word *ki-a-ho-ga*, with the accent on the third syllable, with the *ki* as in kite and the *ho* as in hoe.

Property of the Cuyahoga Foundry Co., is located close to the belt line of the New York Central railroad in Cuyahoga Heights village just outside the corporate limits of the city of Cleveland on the south. Most of the castings made here are for customers in the city and for that reason they are delivered by truck. Proximity to the railroad track from which a spur extends into the yard, facilitates the handling of incoming raw materials, pig iron, scrap, coke, limestone, sand for molds and cores.

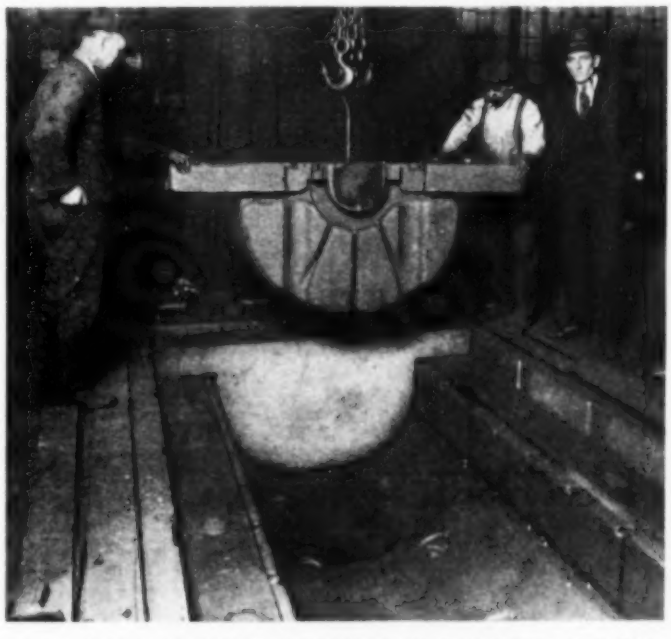


FIG. 1—CORES TO FORM THE INSIDE OF THE MOLD ARE BALANCED FROM A SINGLE HOOK

Starting on a conservative basis, a brick, steel and glass building 109 x 212 feet was designed and erected for an anticipated maximum production of 25 tons per day. The east end of the building for a distance of 29 feet was partitioned from the remainder of the building to serve as a cleaning room. The foundry proper was divided into three longitudinal bays by two rows of steel columns which also served as supports for the crane runway in the center bay.

The center bay 48 feet 7 inches in width, at first was served by a single 10-ton crane made by the Cleveland Crane & Engineering Co., Wickliffe, O. Later this was supplemented by a second crane with a capacity of 15 tons. Singly or, occasionally in combination, these cranes have met all the lifting requirements.

Although long, running jobs are the exception rather than the rule and although a great many of the larger molds are made by bedding patterns in pits in the floor, still the company found it advantageous several years ago to install a portable type sand throwing machine made by the Beardsley & Piper Co., Chicago. This machine may be picked up by the crane and then set up in position close to any flask or group of flasks containing patterns, or, to any pattern located in a pit in the floor. A coarse, open grade sand lends itself readily to use of this machine, also to the formation of skin dried molds and other molds that are dried in the oven.

Large castings that require the service of one of the traveling cranes are cleaned at the east end of the center bay. Tracks leading to the core and mold ovens occupy space at the west end. Part of the floor space in the immediate vicinity of the tracks is utilized by the coremakers, both for preparing the cores for the

FIG. 2—EXTRA WEIGHT IS REQUIRED TO HOLD THE COPE AND CORES IN PLACE IN A LARGE CRANKCASE CASTING

oven and for testing, inspecting, and if necessary, assembling them after they are dried. On account of the peculiar and in many instances, intricate character of many of the castings, dry sand cores are employed to perhaps an unusual extent. Part of the floor in this particular part of the foundry is shown in Fig. 6.

On the north side of the building, a bay 29 feet wide extending the full length of the building, is laid out into 20 side floors extending from the wall to a gangway close to the row of columns. A narrow gage track on this gangway facilitates the movement of many kinds of supplies and materials, including ladles of molten iron during the casting period. A transverse track extending across the center of the main bay carries the ladles to and from the cupola located in the south bay of the building, but with the spout extending to a point inside the main bay and therefore in position to fill the ladles suspended from the crane. A space at the west end of the north bay is utilized as a flask building and repair shop and is equipped with the necessary wood working power tools.

The south side bay is devoted to several activities. The cupola and accessory equipment occupies approximately one-third of the space in the center. Originally space was provided for two cupolas, but only one has been erected. This cupola 84 inches inside the shell and made by the Whiting Corp., Harvey, Ill., was lined for a time down to 60 inches. Later the diameter was increased to 72 inches and up to the present, metal has been delivered sufficiently fast and fluid to meet all requirements. Strength, density and homogenity are secured in the castings by the addition of from 15 to 30 per cent steel scrap in the cupola charge.

A wide variety of small and medium size cores are made on the floor and on benches in the west section of the south bay, that is the space between

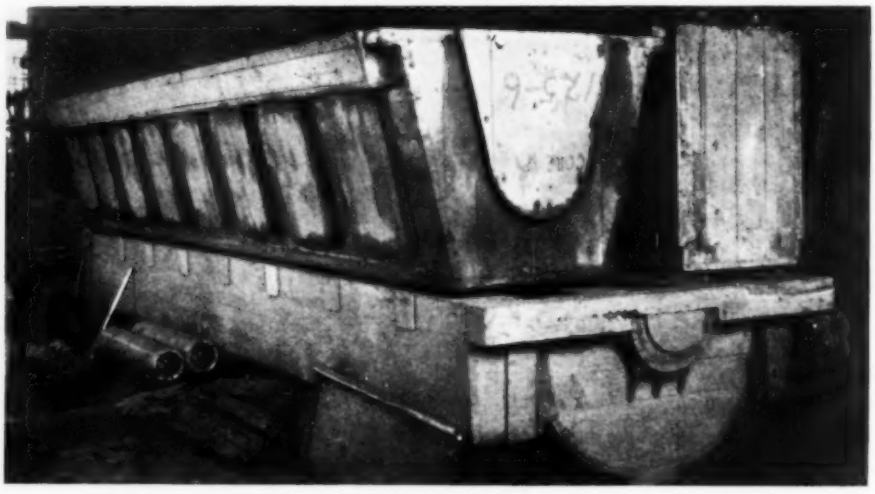


FIG. 4—TYPICAL PATTERNS FOR DIESEL ENGINE CRANKCASES ONLY FORM THE OUTSIDE OF THE MOLD

FIG. 3—THE NEW ADDITION WITH FLOORS EXTENDING FROM THE SIDE WALLS TO A CENTRAL GANGWAY HAS ACCOMMODATION FOR 16 MOLDERS

the cupola department and the west end of the building. An oil sand mixture is utilized for the small cores. Large cores which usually contain a considerable quantity of molding sand, are bonded with a dry binding agent. Interior of the large cores also is filled with coke to hasten the drying period, save sand, assist the core in *standing up* while in the green state, increase the permeability of the core as a whole and finally to help in the disintegration and yielding of the core under the pressure exerted by the casting during the cooling period. The greater part of the coke is recovered in the cleaning room and for that reason the cost of this material practically is negligible.

Space in the south bay east of the cupola room is laid out in a number of side floors where small and medium

size castings are made. A narrow gage track occupies part of the gangway close to the row of columns supporting one side of the crane runway. Metal for pouring the molds in this bay is brought from the cupola in a small buggy ladle. Since the new addition was built at the east end of the building, this track has been extended to serve that part of the foundry. This feature may be noted in the illustration Fig. 3, an interior view of the recently completed foundry addition. Each molder pours his own molds with a hand ladle.

A row of windows in the monitor roof supplements the light and ventilating features supplied by the continuous windows on both sides of the annex. The building is a steel frame structure, with a wood roof, brick end walls and a 5-foot high brick wall under the windows. Floor space has been laid off to accommodate 16 molders working on benches close to the walls on both sides.

The bulk of the castings made in the Cuyahoga Foundry is of widely varying individual pieces rather than in groups of duplicate castings. The men are highly skilled and they capitalize on this factor to the extent that they concentrate on the manufacture of castings that command a premium through difficulty in molding or through other hazard incident to the cycle of operation between the receipt of the pattern and the delivery of the finished casting. Many of the castings are machined extensively and therefore the actual inspection and danger of rejection is not over until after the customer has finished his machining operations. For the foregoing reason, matchplates, followboards and other equipment that figures so extensively and satisfactorily in production foundries, find little application in the Cuyahoga Foundry.

FIG. 6—DRY SAND CORES ENTER EXTENSIVELY INTO NEARLY ALL THE CASTINGS MADE IN THIS FOUNDRY

Several steps in the production of a crankcase for a prominent Cleveland builder of marine engines are shown in the accompanying illustrations. These castings are made in many sizes and minor modifications may be found in pattern design and method of molding. The method shown is fairly typical.

The lowest pattern in the group shown in Fig. 4 is bedded in the usual manner in a pit in the foundry floor containing a layer of coke. After the pattern is removed the mold is blacked and then dried with a number of coke baskets. The pattern forms the bottom face of the mold, but the sides and top are formed with dry sand cores. The side cores are placed in position first as shown in Fig. 5. Then the cores designed to form the inside and top face of the casting are lowered into position as shown in Fig. 1. The ends rest upon the side cores previously placed and their position is decided by prints left by the pattern in the sand at each side of the mold.

For convenience in handling, each pair of cores is made in halves and assembled in the mold as shown. The core is symmetrical, therefore a half corebox is all that is required. The half core is rolled on to a flat plate and the corebox is removed. Long experience has taught the coremaker how to place a hook approximately in the center of the top face so that the core may hang plumb when suspended from the crane. A little pressure by the attendant at either end, equalizes any discrepancy in the balance.

Two iron copes are butted to cover the cored mold. Wedges are tapped between the tops of the cores and the bottom faces of the iron bars in the copes. Then the copes are filled with sand which is rammed down firmly over the cores. The short castings are poured from one end, but the longer crankcases are poured from both ends simultaneously. The inlet gates are located close to the bottom of the mold at one or both ends. On the larger molds the regular rectangular cast iron weights are supplemented by iron flasks, either empty, or filled with sand and recently poured castings as shown in the illustration Fig. 2.

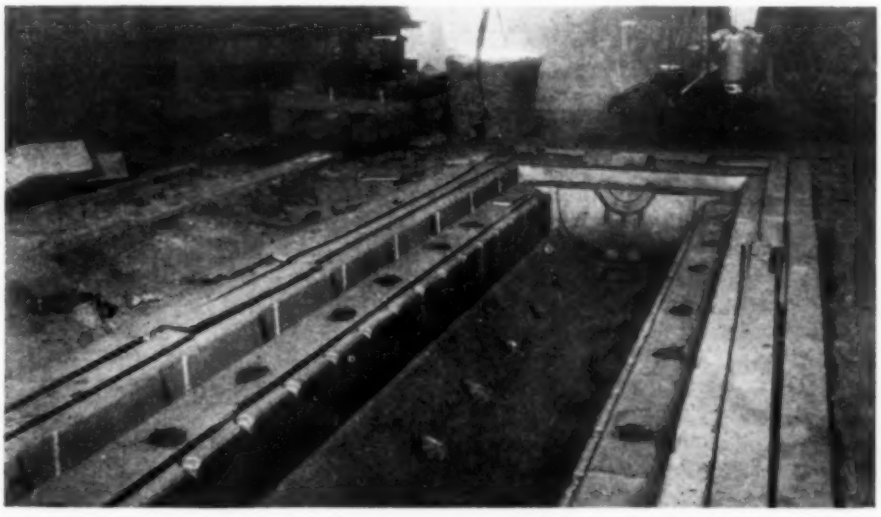


FIG. 5—A SERIES OF DRY SAND CORES FORMS THE FLANGES ON EITHER SIDE OF THE CASTING. A SECOND MOLD READY FOR POURING IS SHOWN IN THE LEFT BACKGROUND

Raymond M. Sievers has been appointed district sales manager of the Harbison-Walker Refractories Co., Pittsburgh. Mr. Seivers' headquarters will be in St. Louis and his territory will extend from the Mississippi river to the Rocky Mountains.

BLAST FURNACE
Operation Affects Quality
of Pig Iron and Castings

By A. L. Boegehold

Part IV

TWO distinct types of microstructure in the pig irons were observed. An example of one type is that exhibited by lot 1 pig iron where the primary graphite flakes are short, and thick, with secondary flakes fairly large and far apart. The other type is exhibited by lot 7 pig iron in which the primary flakes are long, thin, straight and far apart with a matrix of finely divided, closely packed, secondary flakes. It is not clear from data obtained what the factors are controlling these structures or what effect they have on the properties of the cast iron made therefrom.

The outstanding feature of the microstructure of the cast irons was the finer structure possessed by irons poured in the dry sand core molds. This indicates that the iron cools more rapidly in the dry sand core molds than in green sand molds. That this is true can be seen from a comparison of hardness of irons poured in the two kinds of molds. Iron poured in a dry sand core mold is consistently harder than that poured in green sand. The graphite flakes of iron poured in the green sand mold, are usually much larger due to the slower cooling of the iron. The structure of the iron poured in the dry sand core mold is similar to permanent mold cast iron in which the graphite is arranged in a eutectic pattern in finely divided flakes. No relation could be detected between microstructures of pig iron and cast iron made from it.

In every cast iron studied but one, the linear shrinkage was 0.144 inch per foot. Fluidity of the cast iron varied, depending on the pig iron used. Iron made from lot 9 was most fluid. When poured at temperatures between 2425 and 2475 degrees Fahr. it ran 18.17 inches average around the spiral of the fluidity test bar.

Cast irons made from lot 6 pig iron were the least fluid. When poured between 2425 and 2475 degrees Fahr. the iron ran 13.99 inches average. The reasons for variation in fluidity are obscure and this investigation has thrown no light on the question except to supply added evidence that fluidity is a variable quantity depending on other factors in addition to phosphorus, carbon and silicon content, and pouring temperature. It is suspected that the percentage of oxide in the metal has a great influence on fluidity. As there is no satisfactory means of determining oxide content in cast iron, it is difficult to make a suitable study of the phenomena of fluidity.

Draws Conclusions

THIS is the fourth and concluding installment of the series describing the relation of blast furnace operation and iron quality. The author presents his conclusions drawn from the results obtained and states that the two most important variables affecting quality are coke quality and moisture content of the blast. In conclusion he describes a method for determining the combustibility of coke.

In seeking causes for the variation in the effect of pig irons on the physical properties of cast iron, the pig irons investigated were analyzed for nickel, chromium, arsenic and titanium besides the regular elements. The spectrum obtained by producing an arc between two electrodes of the pig iron was studied to discover the presence of any other elements in quantities sufficient to influence the physical properties of the pig iron or cast iron. These tests furnished no useful information.

The investigation discussed in this paper strengthens belief in the idea that physical character of pig iron is influenced greatly by variations in blast furnace operation and that two pig irons may have almost identical chemical composition with respect to carbon, silicon, manganese, phosphorus and sulphur contents but still be as far apart as the poles in physical properties.

Also it is demonstrated quite definitely that the physical characteristics of pig irons persist during remelting in the cupola and greatly influence the physical properties of the cast iron made therefrom.

Data collected and tests conducted show that two things are responsible for a number of variations in blast furnace operation and resultant properties of pig iron. These two things are quality or combustibility of coke and amount of water in the blast. The influence of these variables is just as important in the cupola as in the blast furnace. Just as long as these factors are allowed to vary as they now do, we can expect wide variation in the qualities of pig iron and of the cast iron made from it.

A combustibility test such as will be described, or, a properly conducted rumble test, or both, would suffice to control the quality of the coke. Removal of the moisture from the blast furnace and cupola blasts can be produced economically by an adsorption process. As soon as some pig iron producer is in a position to control these two major causes of variation and a cupola is equipped with a blast dryer, it will be possible to conduct further experiments to trace the cause of variations which as yet have not been explained.

The inferences and conclusions which may be drawn as a result of this investigation follow:

Physical characteristics of pig iron persist through the cupola melting operation and are conferred upon the cast iron to which it is converted.

The formation of iron carbide is fostered apparently by the presence of moisture in the blast. The quantity of combined carbon formed increases with increase of water in

the blast in the furnaces.

Properties of the cast iron which are dependent upon the amount of combined carbon present and upon the ease with which combined carbon is retained by rapid cooling are, therefore, related directly to amount of moisture in the blast.

Machinability of cast iron improves with diminishing quantities of moisture in the blast.

Tendency for the formation of white iron diminishes as the moisture content of the blast is reduced.

Tendency for the formation of shrinkage cavities is decreased by increasing the rate at which the ore burden travels through the blast furnace.

The rate at which the burden is made more difficult by too rapid progress of iron through the blast furnace.

The quality of the coke used in a blast furnace affects the pig iron in several ways making it extremely important to have accurate control of this material.

In the light of information presented, it would seem that the custom in vogue for some time past of referring to satisfactory and unsatisfactory pig iron as *good* pig iron and *bad* pig iron is not particularly well chosen. We are beginning to suspect that there is an endless variety of pig iron dependent for its character upon the constantly changing conditions of blast furnace operation.

The pig iron which may be satisfactory for one man's needs may be unsatisfactory for another and vice versa. If a foundryman has adapted his melting practice to give him good results with a particular kind of pig iron, he will probably have trouble with other kinds and so be inclined to call the pig iron bad which gives him trouble but a readjustment of his melting practice might give him just as good results with that iron.

The thing every foundryman is interested in, I believe, is to obtain pig iron which always behaves the same. What he wants is uniformity of raw material. To get that it will be necessary to start back at the blast furnace and eliminate some of the tremendous variations we known exist there. When we can maintain constant some of the biggest variables in blast furnace practice and make further study of pig irons we will probably learn enough about different kinds of pig iron of like chemical analysis to be able to classify them in something like the manner in which steels of like analysis have been subdivided into fine-grained and coarse-grained, fine-grained normal, coarse-grained normal, fine-grained abnormal and so on. Instead of calling pig iron *good* and *bad* we will refer to it for example as No. 2X soft, No. 2X hard, No. 2X non-chilling, No. 2X l.v.s. (for low volume shrinkage) or by some system of classification which will indicate the character which we can expect to be transposed from the pig iron to the cast iron made from it.

In closing, some of the blast furnace data is presented again to leave with the reader the picture of what a variable thing blast furnace operation is. This is shown in Table VIII.

It happens that these variations did not all occur in the same furnace but there is no reason why they should not and probably do over a period of time. The extreme values given for coke consumption did occur within a week's time in the same furnace.

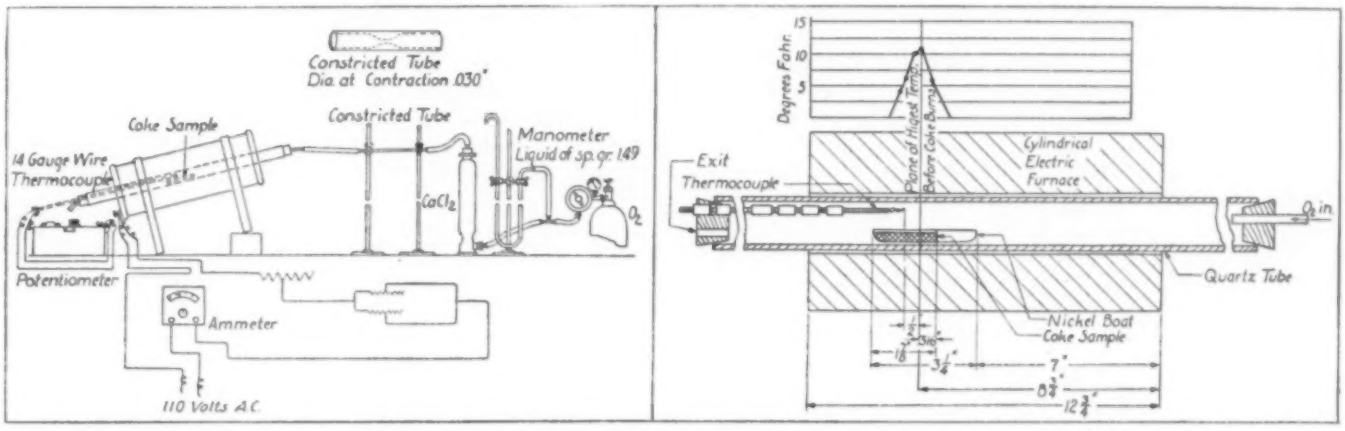


FIG. 23—ARRANGEMENT OF APPARATUS FOR COKE COMBUSTIBILITY TEST. FIG. 24—DETAILS OF APPARATUS SHOWING PLACEMENT OF COKE CONTAINER AND THERMOCOUPLE

can be made to travel through the blast furnace depends upon the burning rate of the coke used.

A cast iron of a given analysis such as total carbon 3.30 per cent, manganese 0.50 per cent, phosphorus 0.15 per cent, sulphur 0.085 per cent, silicon 2.35 per cent, poured in dry or green sand, other conditions being constant, will vary in hardness 25 to 30 points of brinell hardness, depending upon the quality of the pig iron used in the charge.

In a cast iron of above analysis a variation of silicon from 2.20 to 2.50 per cent silicon, other conditions being constant, will produce a drop in hardness from 5 to 30 points brinell, depending upon the quality of pig iron used in the charge.

The factors responsible for variations of tensile strength have not been revealed by this investigation. It can be said, however, that the tensile strength is influenced to a marked degree by the pig iron.

Machinability is improved by use of pig iron which has been reduced completely in the blast furnace and

Until measures are taken to reduce these fluctuations of factors which have a direct bearing upon the quality of the iron, we can expect to get pig iron of variable quality. There is now available means for controlling two important variables which themselves are the main cause of a large share of the other variables. These two variables are coke quality and amount of water in the blast. Means of controlling these have been discussed in this paper.

A combustibility test for coke, which previously has been mentioned, was, developed by the author in the General Motors research laboratories and used by General Motors divisions for testing coke. Methods of sampling and test procedure will be described to enable those interests in carrying out similar tests for coke combustibility.

In sampling, each carload, or its equivalent, should be considered as a unit.

Samples should be taken from the exposed surface of the car. Samples shall be selected along three parallel lines—one running down the center

of the car and the other two along each side, about one foot from the edge of the car. Lumps of coke shall be selected, at intervals of approximately two feet. When two lumps of coke lying side by side where a sample is to be selected are apparently different in quality, both lumps should be selected.

The total quantity of sample collected in the above manner, should be not less than 50 pounds.

This 50-pound sample then shall be reduced in quantity by quartering. The diagonally opposite quarters shall be discarded, thus leaving a sample of 25 pounds. This 25-pound sample then should be crushed to pass through a 1-inch mesh sieve and then quartered twice, reducing the sample to 6 pounds. This amount is crushed until the particles will pass through a ¼-inch mesh sieve and be held on a ⅛-inch mesh sieve. That which passes the ⅛-inch mesh sieve is discarded and the remainder used for the test. From the sample prepared in this way, 6 one-gram samples are weighed out to be used for the combustibility test.

Combustibility test procedure follows:

Apparatus required for this test consists of an ordinary carbon combustion furnace, a thermocouple coated with a refractory cement; a potentiometer, ammeter, calcium chloride tower, U-tube manometer, standard constricted tube, and oxygen supply.

The apparatus shall be arranged as shown in Fig. 23. The carbon combustion furnace is tipped so that the outlet end of the quartz tube is lower than the boat containing the sample, to facilitate the exit of the heavier gaseous products of combustion. The ammeter is placed in series with suitable resistances so that the current passing through the furnace can be controlled accurately.

Amount of oxygen passing through the furnace depends on the pressure and the size of orifice in the constricted tube. The bore of this constricted tube is 0.030 inch. The proper amount of oxygen is obtained by maintaining a manometer pressure equivalent to 22 inches of brom-benzene, having a specific gravity of 1.49.

It is necessary to calibrate the furnace to determine the location of the hottest part of the furnace. With the oxygen current passing through the furnace at the standard rate mentioned previously, a traverse with the thermocouple is made from one end of the furnace to the other, to determine the location of the hot-spot. The position of this point is important in placing the sample in the furnace.

A 1-gram sample of coke is placed in an ordinary nickel boat, commonly used in carbon determinations. The particles of coke are arranged in such a manner that there is only one layer of particles in the boat. The whole sample is confined to 1⅞ inches at the end of the boat, away from the oxygen entrance end.

The nickel boat containing the sample of coke is placed in the furnace approximately coinciding with the hot-spot in the furnace. The exact position of the boat, relative to the hot-spot in the furnace and the thermocouple, is shown in Fig. 24. It is important that this position be maintained exactly in all tests.

When the coke sample is inserted in the furnace, the furnace should be at approximately 750 degrees Fahr. The oxygen current is turned on and the furnace maintained at that temperature for 5 minutes to allow the boat and sample to come to equilibrium. The current, through the furnace heating element, then is adjusted to 2.65 amperes. This current will heat the furnace up at a rate of 7 or 8 degrees per minute.

Readings of the furnace temperature must be taken every 30 seconds until the coke has burnt completely. The ignition temperature of the coke will be indicated by an abrupt increase in the rate of temperature rise of the furnace. When the coke is burnt completely, the furnace temperature again will fall off.

Table VIII

Variable Factors Encountered

	Limiting values observed Maximum	Minimum
Coke used per long ton of iron produced	2440	1765
Pounds of air used per pound of carbon in coke	6.3	4.27
Pounds of air used per pound of iron produced	5.45	3.29
Pounds iron produced per hr. per sq. ft. area at max. diam.	179	95.8
Pounds of water in blast per ton of iron produced	121.6	22

Carpenter & Byrne, 4 Smithfield street, Pittsburgh, have been appointed sales representatives in the Pittsburgh district for the Pennsylvania Pump & Compressor Co., Easton, Pa.

Instruct New Employe in Safety

NOTHING is more important than getting a new man started right, according to *National Safety News*. He may be required to undergo a physical examination, he may be subjected to a lecture on what is expected of him, and he may be asked to read through the rule book and answer questions, all of which are important; but at this stage his mind is occupied with thoughts of whether or not he can make good on the job, will he like his work, and will he be able to get along well with his fellow workers, especially his foreman? While he is in this frame of mind the foreman easily may make a good and safe worker of him if he will but take the time to see that he is introduced properly to his new surroundings and coached in his work. A few minutes of the foreman's time at this stage will save hours of worry later on and will go a long way toward saving the new man from accidental injury.

The foreman may well bear in mind the following points:

Has the new man been equipped with proper protective clothing required for the kind of work he is to undertake?

Will he need goggles? If so, does he have them and do they fit?

Does he already know anyone in the foundry who could help him get acquainted? If not, who is the best man to put him to work with?

Is he acquainted with the principal dangers of foundry work?

Has he been acquainted with the safest short cuts to and from his place of work, to the wash and locker rooms and other such places?

In addition to the foregoing, the foreman displays good judgment if he, himself, puts on goggles and proper protective clothing when his duties require him to be with his men during work in which there is danger of injury. The impression this makes on the new man alone is worth far more than the time and trouble it requires to set the example.

Return Flue Gases Aid Annealing Oven Control

Malleable Fractures Show Definite Equilibrium Between Metallic Constituents and Annealing Furnace Atmosphere

By W. F. Graham

OPERATION of furnaces for annealing malleable iron presents in many aspects a problem peculiar to itself in the art of heat treatment of metals. The foundryman is faced with maintaining an evenly distributed, controlled temperature in a heating chamber containing a relatively large tonnage of material. The desired change in the character of the carbon content of the iron is influenced not only by the temperature and its distribution, but also by the rate of heat input and the rate of cooling of the charge. Furthermore, the atmosphere of the furnace seems to have a great influence on the decarbonization of the surface of the metal through its bearing on the equilibrium of the iron-carbon-oxygen system. Additional factors entering into the problem are the life of the refractories, disintegration of annealing pots by oxidation and fuel consumption. These enter into the cost of the annealing operation in an important way.

In this paper it is attempted to record as a preliminary report a method of firing malleable cast iron annealing furnaces. This method has been applied with a considerable degree of success to two furnaces within the past eighteen months at the Ohio Brass Co., Mansfield. O. The presentation of data is confined to a description of design of apparatus, the method of firing and the results obtained to date. This method of firing was applied to furnaces of the oven type fired with powdered coal.

In July, 1927, a new bank of annealing furnaces was put into operation. In designing these furnaces, the engineers provided ample insulation to prevent heat losses. Rather careful studies were made of the firing program and it developed that while it could be made satisfactory from the standpoint of uniformity of temperature and its control, it was almost impossible to approach a neutral atmosphere during the holding period and maintain, at the same time, uniform temperature. The reason for this condition seemed to be that the rate of heat dissipation through the furnace walls was so low that unless the flame was cooled by a considerable air excess, one of two effects would be observed: Either the temperature of the rear of the furnace would be too high or, if the volume of burner gases was reduced, there would not be sufficient gas carried forward in the chamber to evenly distribute the heat to the front end.

Reduces Oxygen

WHILE powdered fuel firing has shown excellent results on malleable annealing ovens, some difficulty has been encountered in the holding period due to the excessive air required to blow in the fuel, above that necessary for complete combustion. In this article which is abstracted from a paper presented at the annual convention of the American Foundrymen's association held in Chicago, April 8 to 11, the author describes a method for substituting flue gas for excess air at the burners. Mr. Graham is a member of the technical division, Ohio Brass Co., Mansfield, O.

While the efficiency of these furnaces was satisfactory and the annealed iron met all requirements, it was felt that if it were possible to control the character of the furnace atmosphere, many beneficial effects would accure. Before two more furnaces were put into operation in May, 1928, it was proposed to return to the furnace chamber some of the waste gases or products of combustion in order to provide greater gas volume, or pressure within the furnace.

A section showing flue arrangement of the furnaces, and overall dimensions is given in Fig. 2.

The return of the waste or flue gases was accomplished in three stages of experimentation. The first trial was made with gas returned from the flue above the drum on top of the furnace to an opening in about the center of the roof. The results were unsatisfactory, and even disastrous to the pots located immediately under the opening, as apparently a secondary local combustion took place here.

It then was decided to return the gases through the carburetor and burner. Accordingly, a pipe was run from a point on the flue above the exhaust fan to a mixing chamber between the air inlet gate and the carburetor. This pipe was led out of the flue at 4 inches diameter, expanding to 10 inches diameter, as it was thought at the time that it would be necessary to cool the return gas somewhat. A damper above the mixing chamber and one in the stack with the previously mentioned construction controlled the amount of return gas that was mixed with the inlet air.

After a number of trials during several annealing cycles, it was found that an appreciable amount of returned gas could be mixed with the inlet air. The exhaust fan could be shut off during the holding period and the oxygen content of the furnace atmosphere reduced from 8 to 10 per cent to under 1 per cent. The carbon dioxide content was 18 to 20 per cent. The temperature of the furnace was easy to control and there was a uniform condition of temperature as indicated by the front and back thermocouples. The annealed iron was excellent in quality as indicated by many fractures, showing little "picture-frame" effect.

The previously mentioned flue arrangements were made on No. 5 furnace and it will be understood that the

return gas firing program applies only to the holding period, although the neutral atmosphere generated would tend to hold between 12 and 24 hours on the cooling period. On account of the favorable operating results obtained on No. 5 furnace, it was decided to equip No. 6 furnace with a somewhat improved return gas system. The principal changes were to eliminate the 4-inch construction in the return pipe and to provide means to either by-pass the exhaust fan or use it as a venturi exhaust or use it directly. The return gases were withdrawn below the exhaust fan. This latter adaptation of the flue system is shown in Fig. 1. This furnace has been operating with returned flue gas since January, 1929, with satisfactory results as to control and quality of product.

A discussion of the result obtained from this method of firing annealing furnaces might readily fall into two classifications, namely, the principles of combustion involved and a consideration of the effect on the equilibrium of the iron-carbon-oxygen system as it relates to the stability of the surface layer of the ferrite-temper carbon composition.

Return gas was brought into the mixing chamber at 600 degrees Fahr. and then through the carburetor, producing a temperature of 400 degrees Fahr. immediately below the burner. While this degree of temperature carries an appreciable amount of heat into the burner gases, it is doubtful whether it directly represents a saving in fuel, as the carbon dioxide in the return gas absorbs more heat to bring it to flame temperature than the oxygen in excess air.

We are not yet able to report figures which would give accurate comparisons of coal ratios, but it would appear that the coal consumption in this method would be low, due to uniformity of temperature and the ease of control. Data as to pot life are not yet available, although visual examination indicates less formation of scale. In this connection, it may be said that the character of the furnace atmosphere has been determined by the eye, checking with numerous intermittent gas analyses, as carbon dioxide and carbon monoxide meters have not yet been installed. No attempt has been made to carry more than a fraction of a per cent of carbon monoxide.

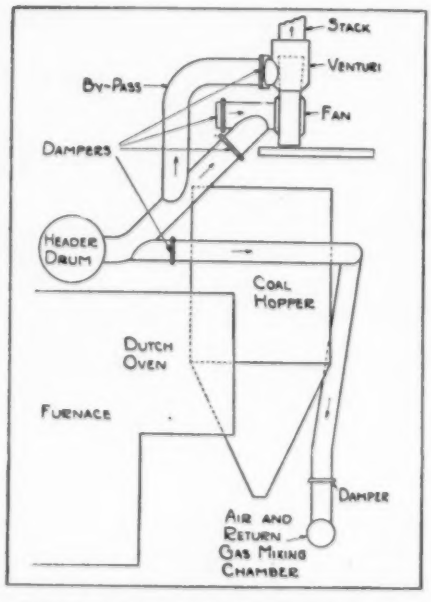


Fig. 1—Detail of Flue Arrangement

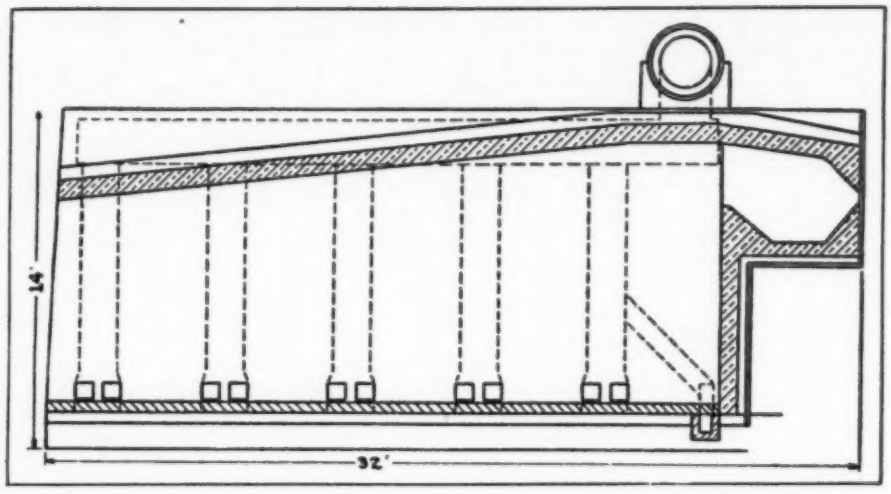


Fig. 2—Section of Furnace Showing Flues and Over-all Dimensions

The stability of the surface and the surface layer of the malleable cast iron during the annealing cycle has received the attention of a number of competent investigators in recent years. The formation of scale on the castings and a "picture-frame" structure either ferritic or pearlitic, are effects of conditions, more often than not, incapable of interpretation by the practical foundryman.

Our study of fractures of iron from annealing cycles operating on return gas indicates that a marked effect has taken place, and it is reasonable to assume that it can be explained by a definite condition of equilibrium between the constituents of the iron and the furnace atmosphere if all data were available. It is hoped at some future time that it will be possible to report further progress in the study of this subject.

Issue New Catalog

Tabor Mfg. Co., 6225 Tacony street, Philadelphia, recently has issued an interesting loose leaf catalog. The catalog contains four bulletins on power and jar squeezers, flask lift machines, rollover-pattern draw machines and plain and shockless jarring machines. Each section contains illustrations of the various types of machines described and gives the stock sizes. The publication also contains valuable information on the mounting of patterns of various types on the machines, describing and illustrating the methods. The folders also contain reproductions from photographs of typical installations.

Eastern Sand Properties Change Ownership

Whitehead Bros. Co., 537 West Twenty-seventh street, New York City, has acquired the foundry sand properties of Charles E. Pettinos, 1 East Forty-second street, New York City. This includes the operations in the Albany, Lumberton and South Jersey districts. The transaction involves the sand operations only of Charles E. Pettinos and was negotiated so that this organization can give its entire time and attention to the graphite, plumbago and foundry facing business.

Publishes Bulletins

Bureau of standards, Washington, has published several bulletins as follows: "A New Determination of the Melting Point of Palladium," by C. O. Fairchild, W. H. Hoover, and M. F. Peters; "Thermal Expansion of Tantalum," by Peter Hidnert, and "Visitors' Manual of the National Bureau of Standards." The first bulletin is designated as research paper No. 65; the second as research paper No. 62, and the third as miscellaneous publication No. 93. Copies of the first two publications may be obtained from the superintendent of documents, United States Government Printing office, Washington, for 10 cents and 5 cents, respectively. The last mentioned may be obtained free of charge.

The FOUNDRY Family Photograph Album

Upper Left

F. T. MORAN

Peninsular Stove Co., Detroit

Lower Left

J. PRENDERGAST

Sullivan Machinery Co., Claremont, N. H.

Upper Right

D. A. BLAGDEN

General Steel Casting Co., Baldwin, Pa.

Lower Right

O. L. JONES

Illinois Clay Products Co., Joliet, Ill.

PROPOSED GOVERNMENT SPECIFICATION
FOR FOUNDRY FACING, CARBON BASE

GENERAL SPECIFICATIONS

There are no general specifications applicable to this specification.

GRADE

This specification covers five grades of foundry facing as shown in the accompanying table.

MATERIAL AND WORKMANSHIP

The manufacturer is given wide latitude in selection of raw material and processes of manufacture, so that he may furnish products of highest quality.

GENERAL REQUIREMENTS

All materials covered by this specification excepting Grade *E* are for general use in iron and brass foundry work for coating the face of sand molds either in dry or wet form.

DETAIL REQUIREMENTS

1. Foundry facing shall conform to the requirements shown in the accompanying table.

REQUIREMENTS FOR FOUNDRY FACINGS

Grades	Per Cent to Pass a 60-Mesh Sieve	Per Cent to Pass a 75-Mesh Sieve	Per Cent to Pass a 100-Mesh Sieve	Per Cent to Pass a 200-Mesh Sieve	Per Cent Volatile Matter Maximum	Per Cent Fixed Carbon Minimum	Per Cent Ash Maximum	Per Cent Graphitic Carbon
A.....	100	.....	90	85	.....	.....	.....	*90
B.....	100	.....	.....	.....	.....	.....	35	.....
C.....	.....	100	98	75	5	.....	45	†55
D.....	.....	100	75	.....	.....	.....	.....	.....
E.....	.....	.....	40	25	*20 †40	*55	10	.....

*Minimum. †Maximum.

Grade *A Ceylon* graphite foundry facing to be of the best grade of foliated graphite, finely ground, for use on green sand molds, material to be of such quality that it can be applied to damp sections of the mold without causing tearing of the sand.

Grade *B, silver lead* foundry facing shall consist of finely powdered graphite, free from coal dust or other forms of non-graphitic carbon.

Grade *C, foundry blacking* shall be amorphous or flake graphite suitable for mixing to form a wet wash for coating exceptionally heavy dry sand molds such as cast iron rolls, ingot molds, etc.

Grade *D, charcoal foundry facing* shall consist of finely powdered charcoal, free from coal dust or other forms of carbon. The earthy matter, or ash, shall be fine, smooth, and free from grit.

Grade *E, sea coal* or bituminous foundry facing shall consist of finely

(*Concluded on Data Sheet No.* 768)

PROPOSED GOVERNMENT SPECIFICATION
FOR FOUNDRY FACING, CARBON BASE

(*Concluded from Data Sheet No.* 767)

powdered coal dust and be of such consistency as to permit its use on simple green sand molds or of its being compounded into facing mixtures.

METHODS OF INSPECTION AND TESTS

Containers shall be opened at random and samples taken and tested to ascertain that the material conforms to the requirements of this specification.

Moisture Test.—Weigh 10 grams into a weighed weighing-bottle (wide shallow type), dry at 105 degrees Cent. with cover removed for 1 hour, cover, cool and weigh. Difference is moisture.

Volatile Matter, Fixed Carbon and Ash Tests.—Weight 1 gram of the dried sample into a weighed platinum crucible with tightly fitting cover, heat, using bunsen burner for exactly 7 minutes, flame 7 to 8 inches high (standard method for coal), transfer to dessicator, cool and weigh. Difference is volatile matter. Heat again; this time remove cover (burn off any carbonaceous matter adhering to cover), then heat crucible to constant weight. Difference between this and the last weight is fixed carbon. The difference between the crucible weight and the last weight made is ash.

Dry Sieve Tests.—

(*a*) Sieves used in this test shall conform to the U. S. Standard sieve specification or A. S. T. M. E-11-26.

(*b*) The sieving operation may either be performed by mechanical shaker or by hand, with the coarsest sieve on top, the various sieves assembled in sequence named with dust pan on bottom. Place 10 grams dry sample on coarsest sieve, cover, and then shake not more or less than 5 minutes. Weigh sample retained on each sieve and in pan, express weights in percentage of material passing through each sieve.

PACKING AND MARKING OF SHIPMENTS

Unless otherwise specified, material shall be delivered in strong, tight, well-coopered barrels of about 500 pounds net weight. Each container shall be marked plainly with the contract purchase order number, name of manufacturer, the material, the net weight and grade.

NOTES

Contracts and purchase orders should state what grade of material is required.

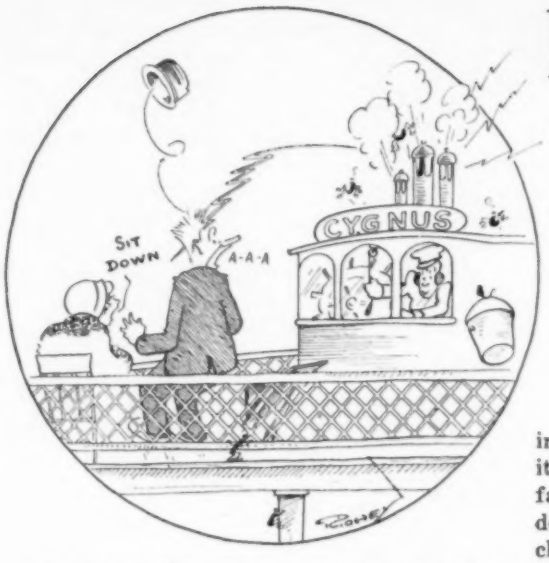
When submitting bids, bidders should furnish a two pound sample of the facing they propose to furnish. Such samples shall be furnished in a neat tin container and should have the name of the manufacturer or contractor and the grade of the material as designated in this specification distinctly marked thereon.

THE FOUNDRY DATA SHEET, JUNE 1, 1929

Payment will be made for all contributions on foundry and pattern shop practice suitable for publication

Bill Describes Cores for Gas Engines

By Pat Dwyer



MELLOWED and toned down by distance, the long blast of an ore boat siren came floating through the quiet dusk of an early summer evening to where Bill and I sat smoking the pipe of peace on the veranda. Without the least desire to stir up an argument of any kind, I commented idly on the difference between hearing one of these whistles at a distance and hearing it close at hand. In the present instance it was comparatively mild and far away and served merely as a gentle break in the stillness of the evening. Not exactly as soothing as one of Mr. Tennyson's horns of elf land faintly blowing, but nothing to get excited about. Quite a contrast to the hoarse, roaring blast that shatters the air, causes the hair to bristle on the back of one's neck and sets the deck plates vibrating under the feet of a person standing near the smokestack.

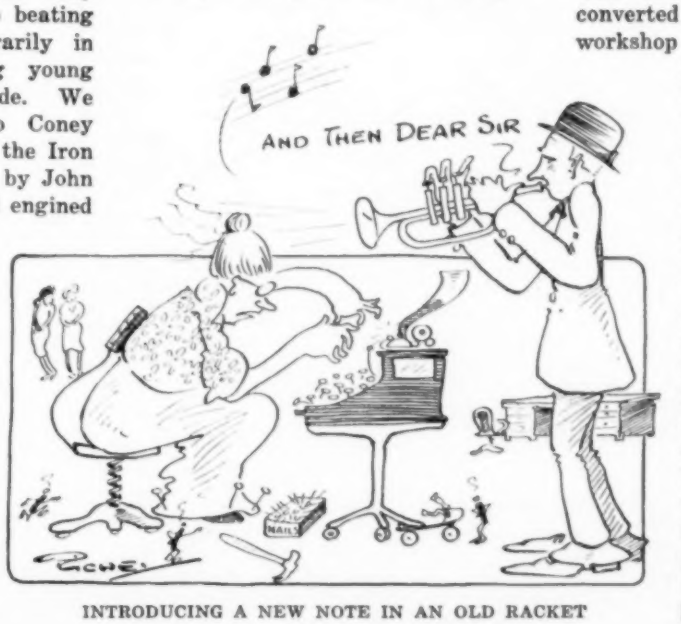
"The first time I heard one of these whistles close at hand," Bill said, "I bet I jumped two feet. The only reason my heart did not stop beating was because it was temporarily in the keeping of a charming young creature who sat by my side. We were on our way down to Coney Island on the Cygnus, one of the Iron Steamboat Co.'s vessels, built by John Roach in his Chester yard and engined by W. & A. Fletcher Co., Hoboken, N. J. I don't know when the boat was built, but I guess she will last forever. She was a venerable old tub when I made that first trip 30 years ago. A year or two ago I was down that way and for old time sake the Missis and I decided to take to the high seas again and visit Coney Island. We went down to the Battery expecting to find something new and snappy in the way of a boat. Believe it or not, my lad, the same faithful old Cygnus took us down the bay. She had not changed a hair in that time. The same old brass strips on the stairways, the same gallant old engine and I am inclined to the opinion, the same engineer. I wanted to engage him in conversation to settle this point but the Missis dragged me away. 'For heaven's sake' said she, 'can't you get your mind off these old engines and things for one day?'

"Women sure are funny birds," he continued meditatively, "you can't please 'em. Old Solomon had the right idea. He surrounded himself with about 1000. Any program he proposed might be voted down by the majority, but it was bound to be accepted by a few, even if it was accepted merely to spite the others."

"Your reference to the engine in that boat," I said, "reminds me of an item I clipped out of a New York paper some time ago. I had intended to mention the subject at the time, but forgot it in the rush and one thing and another connected with the convention. To a certain extent this newspaper story bears a striking resemblance to the standard old vaudeville wheeze of the Irishman whose dying request was that he should be buried in a Jewish cemetery on the theory that it was the last place in the world the devil would think of looking for him."

"If I am not too nosey," Bill inquired politely, "would you mind telling me what you are talking about—if you know? What have an Irishman and the devil got to do with a Coney Island excursion steamer?"

"This newspaper clipping," I explained as I selected it from a miscellaneous collection, "is taken from a New York paper of March 24 and deals with the final disposition of a foundry that has been doing business in Hoboken since—well—I don't suppose any person is left to remember when it started.

"Of course that factor in itself is not so remarkable. Many old business places still survive down among the docks and railroad yards. The remarkable feature about this particular place, the feature that earned it a few inches of space in a crowded paper, is that it was bought by a book man, an author, one of these lads who write for a living, a lad who converted it into a combined office, workshop and lunch room. Listen: Henceforth Christopher Morley, the novelist, who embarked on a career of an impressario last Labor day in the production of a series of old melodramas in his newly acquired Rialto and Lyric Theatres in Hoboken, will do most of his cogitating on such ventures in an abandoned foundry close to the theatres. This became known yesterday when Judge Runyon in the federal court in Newark approved Mr. Morley's purchase of the foundry at 110 River street for $68,000. The plant which had been owned by W. & A. Fletcher Co., had been placed in the hands

INTRODUCING A NEW NOTE IN AN OLD RACKET

of receivers some time ago in bankruptcy proceedings and it was necessary to obtain the consent of the court before the purchase could be effected.

"There you are," I said. "Perhaps you see the connection now."

"No," said Bill, "I don't. And another thing young feller-me-lad, if you were not such an easy mark, believing everything you read I could tell you a few things—"

"Toot, toot, Bill," I warned him. "In other words my lad stick on the brakes. We are starting on a long down grade. On the general theory that half the stuff you see in the papers is unreliable and the remainder has to be scrutinized carefully and then thrown out of the window, I sent the clipping to a lad in the big town and asked him to find out for me whether or not the story was true. I told him all I wanted was a single *yes* or *no*. He did better than that. He called in his trusty stenographer and sent me the following letter: Dear Pat: Greeting and so forth. What's an old foundry or two among friends? I suppose out there in the West you and Bill are just beginning to creep out of the den in which you hibernated for the winter and as a result you have not yet caught up with all the gossip. The doings of Mr. Morley during the past fall, winter and spring, have furnished the up and coming copy boys, newspapers and magazines, with lots of material. If I had the time I could hunt up some of the old files and send you a mess, but my precious time is limited and you will have to be satisfied with a general summary.

"For a lad who has no time," Bill commented, "he certainly makes a fine start. I'd like to see and hear him in action when he has an hour to spare. Go ahead with the summary."

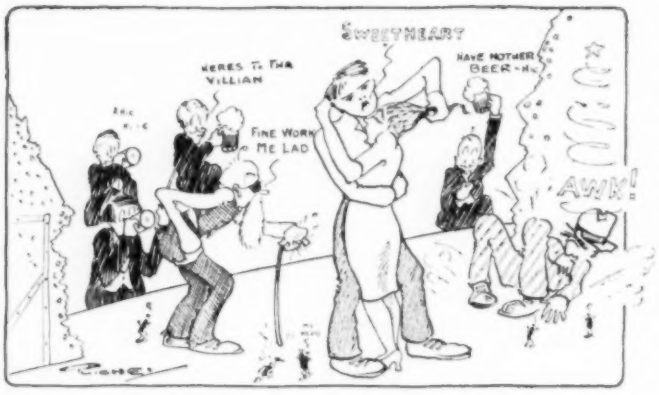
"I could go ahead faster," I pointed out, "if you reserve your remarks until after I have finished. Wait until I finish reading the thing and then I shall be glad to accord you the privilege of the floor."

"Oh! All right," said Bill. "Go ahead and read the drivel, but I am warning you right now you are wasting your time. I can give you some inside dope on that thing, but if you want to take enough rope to hang yourself, why go ahead and take it. What did this short and snappy guy, this bird who is so sparing of his words write next?"

"Plenty my boy," I said. "Plenty and then some. Rally around and see if you can catch an earful."

Looking around for an effective weapon to knock 'em dead, which simply is another way of saying a publicity device that would help to pack the old Rialto and Lyric in Hoboken, N. J., dark, Lo! these many years, Christopher Morley hit on the extraordinary idea of buying an old foundry and converting it into—you'd never guess—a suite of offices for himself and associates and headquarters for the 3-hours-for-lunch-club which he had founded some time before.

The plea that the building at 110 River street is just around the corner from the theaters in which Mr. Morley is presenting old time thrillers to capacity audiences and thus is in a position to keep him in close touch with his work, is regarded by his sophisticated customers as something which rightfully should be entered in the doubtful column. Others, who are not customers, also share this view. Briefly (they say) it is just that much boloney. Cru-ell woids, Hoiman, but you must remembah, no matter how thin you slice boloney it is still boloney!



THE VILLAIN (R.C.) GETS HIS IN ACT IV

Legal complications of one kind and another, also and how, had placed the foundry of the W. & A. Fletcher Co., in the hands of a receiver. It was—if you get the analogy—in the same position as the dear old farm in Acts I, II and III of the old time mellerdrammer, going—going—go—

In the fourth act, Mr. Morley, known to the world—and other papers—as Mr. Morley, but still as simple—I mean simply as—Chris or Kit to the true loving hearts in the old homestead—Kit dashes up and planks down $68,000. Six-tee-Eight-Thou-sand-Dollahs! Sah!—Please do me the fa-vah to count it, or them! Right? He planks down $68,000 and lifts the gol ding moggidge. By heck!

There the analogy ends. In the original version as played in the eighties and nineties—also in some of the plays sponsored by Kitty in the present reincarnation of the Rialto and Lyric theaters—the hero pays the money down on the nail, or the bottom of an upturned milking pail. Then he promptly turns the prop'ity or whatever is left of it, over to the stern old father in cowhide boots and a chin whisker who had driven him away in disgrace many years before under the mistaken impression that he had stolen the Dockiments.*

Editor's note. What documents?

Author's note. Why the papers, to be sure! Don't be so dumb.

In the present instance the hero buys the property and as nearly as one may judge with the naked eye, he intends to keep it for himself. As hereinbefore stated, he bought it to convert it into a suite of offices and a rest room for those who need—and can afford—three hours for lunch. Thus passes out of the picture the foundry of one of the most famous marine engine building shops in the country. The building may attain a certain amount of fame or notoriety if the present owner's theatrical star remains in the ascendant for any considerable period of time, but it is reasonably safe to say that the place never again will be as famous as it was in the days when it set the pace in the design and construction of engines that go down to the sea in ships.

In one sense, that is as an individual firm, the company itself has passed out of existence early this present year. It was merged with five other shipbuilding and repair plants in the New York metropolitan district to form the United Dry Docks, Inc. In the event you may be interested, the other companies include James Shewan & Sons, Inc.; Staten Island Shipbuilding Co.; Alderton Dry Docks; Morse Dry Dock & Repair Co.; Theo. Crane & Sons Co.

"I rawtheh fauncy, me good man," I said, "that will hold you for a while!"

"Well," said Bill, "I'll tell you. You are partly right, but mostly wrong, as usual. Morley secured the building at 110 River street for an office, but the building was not and never had been a foundry. It was not a part of the W. & A. Fletcher Co., plant. It was not sold to close an estate. The shipyard does not operate an iron foundry. The building previously had been occupied by a steel fabricating company who built many things, including such prosaic devices as wheelbarrows for every purpose.

"Outside these trifling exceptions, the article as it appeared in the New York paper and as it was confirmed by your parsimonious friend who is so tight with his words, was substantially correct.

"Perhaps I should mention one other item. Mr. Morley does not depend altogether on the pure dramatic urge to fill his theaters. Neither does he depend exclusively on the local inhabitants of Hoboken, Weehawken, Bayonne and Jersey City, to say nothing of the other well known and euphonious Jersey towns, Netcong, Hopatcong, Metuchen and Secaucus to snap up all the entrance tickets for his performances.

"It is claimed that most of his patronage comes from across the North river where it is said people are more easily amused and more willing to pay for amusement, than an equal number of people any other place on earth. Novelty of the old plays and the old theaters, draws crowds across nightly by ferry and tunnel. They guffaw loudly at the devilishly wicked 'Black Crook.' They'll do the same to 'Uncle Tom' with all its implications, the 'Blue Lagoon' and the 'Octoroon,' the old 'Ten Nights' and 'London Lights' and similar vexations. The 'Prodigal Son' will have its run and even dark 'Othello.' Then they'll probably swing back to 'What Price Glory,' although it's gory and filled with what-the-hello! That's rather a neat touch eh?

"The fact that patrons may partake of—are cordially urged to—partake of refreshments during, before, after and between the acts, may or may not be a contributory factor. That's just the kind of a stunt you might expect from a guy who belongs to a three-hours-for-lunch club. Grub and drinks constitute a bait, whether singly or together, that never fails to jam 'em in and fill the old joint to overflowing.

"However, we are drifting a long way from the W. & A. Fletcher Co. This company has had a long and honorable career as ship and engine builders. It began with the old walking beam type and progressed through the inclined reciprocating, vertical triple and quadruple expansion types. It was the first company on this side of the Atlantic to build and install the Parsons turbine and one of the first to take up the diesel engine. If you want to realize something of the progress in engine building, just take a look at a modern diesel and compare it with your old walking beam engine in the CYGNUS, built in 1881 with a cylinder 53 inches diameter and 12 feet in length.

"I had an inquiry recently from a foundryman who said he had orders for several gas engines, but since these castings differed in many respects from the castings usually made in his shop, he had experienced considerable difficulty, particularly in his attempts to make the cylinders. He had tried several sand mixtures without success. The cores either broke or caused the iron to blow. He wanted a proper formula for making cores of this kind.

"In my reply I directed attention to the somewhat important fact that he had not indicated what size engines he was making, therefore it is impossible for any person to give a definite formula for the core mixtures. Sand that might be used with perfect propriety for large cores, would be altogether too coarse for small cores. A certain amount of molding sand may be added to the mixture for large, bulky cores to give them stability while in the green state. The least addition of molding sand to small core sand mixtures is fatal because it closes the spaces between the grains and thus interferes with the rapid escape of the gas. The gas generated in a large core usually has a reasonable time to escape before the mold is filled with iron. Gas from a small, intricate core has to escape almost instantly. Therefore it is essential that the core shall be as porous as it is possible to make it while still retaining its strength.

THE BOYS TRY PERMEABILITY AND BOND TESTS

"For small and medium size cores, sharp sand is employed exclusively. It may be either beach or bank sand provided it is free from any trace of organic material. Usually a bank sand is preferable, since beach sand carries a certain amount of salt and sometimes is heavily impregnated with lime from shells. Practically any type of binder may be employed, provided the foundryman is familiar with its characteristics. However, foundrymen practically are unanimously of the opinion that an oil binder is the most satisfactory for these cores. The oil may be raw or boiled linseed, or one of the proprietary compounds in which linseed oil is the base.

"The amount of the binder may vary to some extent depending on the size and shape of the core. This point only can be determined by experiment under local conditions. Usually the binder is added in the proportion of 1 part binder to between 30 and 40 parts sand. Except in the very largest sizes, the sand is not rammed in the usual manner. In some instances it is pressed down by hand. In others it is jolted a few times on a hand or power operated machine.

"In certain types of cores, vent rods are bedded in the sand and are removed before the corebox is lifted from the plate. This applies particularly to the jacket cores which are surrounded almost entirely by iron when the casting is poured. Many foundrymen incorporate lengths of vent wax in their cores to provide free channels for the escape of gas from sections that ordinarily present difficulties. The subject of cores and core mixtures particularly in its application to various forms of gas engines has been covered many times in the pages of THE FOUNDRY. In the event he had access to back numbers I suggested he should consult the issues of Jan. 15, Feb. 1, Feb. 15 and March 1, 1922; also Sept. 15 and Nov. 15, 1924."

Report on Grate Bars

At the annual convention of the International Railway Fuel association held in Chicago, May 7 to 10, a committee report was presented on the use of special cast iron and steel grate bars in locomotives. Information was received from 59 railroads which showed that 38 used plain cast iron, and 21 used special materials in grate bars on 2200 locomotives. Of the 21 roads, 11 regard the duration of experiments too short to warrant an opinion on the relative economy, 7 report that special materials are more economical, 1 finds them less economical, and 2 made indefinite reports. Materials in use include low chrome-nickel, white cast iron; steel containing 1.53 to 1.55 per cent nickel and 1.59 to 1.64 per cent chromium; cast steel containing 0.25 to 0.30 per cent carbon, 0.6 to 0.7 per cent manganese, and 0.30 to 0.40 per cent silicon, special cast irons, semi-steel, etc.

Use Surface Grinding

To Machine

Gray Iron Castings

GRINDING and the grindstone have been known for many years, but the development of grinding operations and tools has been of comparatively recent origin. With the discovery of carborundum in 1891 by E. G. Acheson, the use of grinding as a method of removing excess stock was given great impetus.

Grinding is used in all foundries and has become indispensable in cleaning and finishing castings. However, its use in the machine shop has been more or less limited to finishing work. The use of the grinding wheel as a tool for machining a casting from the rough surface to the finished piece was unheard of a few years ago.

The Diamond Machine Co., Providence, R. I., has adopted the grinding wheel to finish flat surfaces on many jobs. The rough casting is set in the machine and the surface ground to a finish in much less time than was possible by the old method using a planer. An illustration of what can be done with this method, is the finishing of a cast iron motor base shown in position for grinding in Fig. 1. This is an ideal piece to finish by this type of grinding as it embodies an interrupted surface. Such a surface helps to keep the grinding wheel free cutting at all times as an ample chip clearance is afforded. As Fig. 1 shows, the work is located against an angle iron fixture and held in place with hook bolts. This grinding operation cleans both sides of the piece and the production time is 40 parts per hour. When it is considered that this means 1½ minutes each, floor to floor time, the results are quite remarkable.

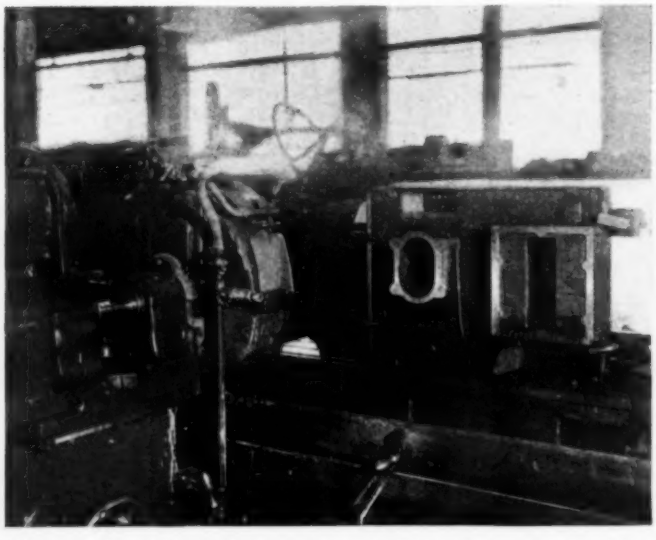
Grind Large Castings

The part illustrated on the grinder shown in Fig. 2 is a cast iron bed plate. The largest ground diameter of this piece is approximately 36 inches. The work is held against angle irons by means of straps and bolts, one of which is shown in the opening back of the large circular rib. This part lends itself readily to finishing by grinding as it has an interrupted surface. With work of this type the grinding wheel can operate at maximum efficiency at all times. In finishing this piece ⅛ inch of stock was removed from each side. The grinding time was 12 minutes for the top, and 8 minutes for the bottom surfaces, respectively.

The part shown in Fig. 3 offers another interesting example of grinding cast iron from the rough. While this is not as ideal a surface as the one shown in Figs. 1 and 2, the floor to floor time is 27 minutes in removing approximately ¼-inch of material. The previous time for planing these pieces was 45 minutes. The introduction of grinding in this case reduced the production time over 50 per cent. This is a splendid saving that is worth consideration. In this instance the design of the part lends itself admirably to grinding. As the illustration shows, the work is held in place against an angle iron by bolts that pass through holes in the piece. Dog screws at one end serve to level the work.

The part shown in Fig. 4 is a cast iron drier frame for a paper making machine. It is strapped to the grinder table, while a jib crane also is employed to take the weight of the overhanging end. The ground surface is 44 inches long and 10¼ inches wide and in removing ⅜-inch of material the grinding time was 25 minutes. In this case the amount of metal removed per minute was very nearly 7 cubic inches.

This should be of interest to the foundryman that machines his castings before they leave the plant. However, it must be borne in mind that this type of machining is only applicable to surface finishing. For any one



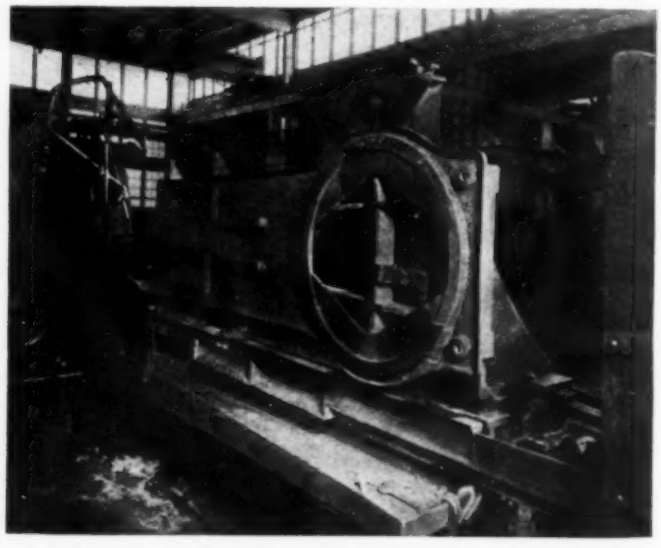


Fig. 1—Cast Iron Motor Bases of This Type Are Finished at the Rate of 40 Per Hour. Fig. 2—Cast Iron Bed Plates Are Ground on Both Sides in 20 Minutes

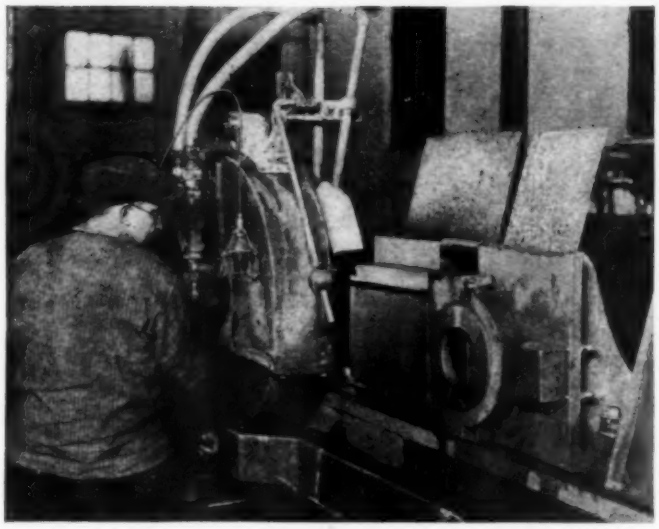


Fig. 3—On this Job the Production Time Was Cut From 45 Minutes to 27 Minutes. Fig. 4—This Cast Iron Dryer Frame for a Paper Machine Was Ground in 25 Minutes

who has work of that type, it is quite evident that a considerable saving may be gained by the adoption of the grinding method for the finishing of the kind of work discussed.

Readers Comment

Note—Material appearing under this head does not necessarily reflect the opinion of THE FOUNDRY or of its editors.

TO THE EDITORS:

In the May 1 issue of THE FOUNDRY I noticed a question entitled, "Plug Taphole at Start," and I would like to present my method of treating this phase of cupola operation so that it may assist others. For the last three years I have been in charge of four cupolas, two of which are 66 inches in diameter and two 70 inches in diameter. I never have blown in the tapholes and never have had the misfortune of dropping the bottom due to a frozen breast. Blowing the taphole is poor cupola practice and a waste of power and iron.

The bottom of the cupola should be from 4½ to 5 inches thick and composed of sand tempered the same as for molder's use. It should have a pitch of about 1½ inches from the slaghole side to the taphole so that the iron will drain properly. In putting in the breast, place a bar of the proper size in the spout and allow it to extend through the breast opening. Take pieces of coke and fill up the opening about 3½ inches back of the breast block. Then put in the breast block and ram in the breast clay or other material. I use sand mixed with core binder for this purpose. This material is laid on 2½ inches thick and cut out so that it is only about 1½ inches thick around the hole.

After the taphole has been dried out with a blow torch, it is filled with graphite which easily may be pushed out with the tapping rod. The breast is made about 1¼ hours before the blast is turned on so that the breast will be good and dry. The cupola is lighted at 2:30 a. m. and charging is started at 4:30 a. m. The blast is put on at 6:15 with a pressure of 12 ounces until the iron is tapped around 7 o'clock. Then it is increased to 15 ounces until 4 o'clock when it is cut back to 10 or 11 ounces and held at that point until 5 o'clock when the cupola is dumped.

To prevent oxidation I carry the bed 26 inches above the upper row of tuyeres. Iron charges weighing 5000 pounds are used with coke splits of 500 pounds until the cupola is filled. The coke then is cut to 450 pounds until 10:30 a. m. when the splits are reduced to 400 pounds at which point they are carried for the remainder of the day. From 120 to 125 pounds of limestone are used with each charge and the slaghole is kept open from the time the blast is put on. The crucible or well of the cupola is 18 inches deep from bottom to slaghole and the slaghole is 4 inches below the lower tuyere.

If the coke bed is kept at the proper height, iron should trickle down past the tuyeres 6 or 7 minutes after the blast is turned on. Tapping should begin when iron shows at the slaghole which will be 35 to 40 minutes after starting the blast. With the method of operation outlined, the temperature of the iron should average around 2600 degrees Fahr. and will maintain this temperature throughout a 10-hour heat.

CHARLES N. GUIN.

Burlington, N. J.

Conditions Patterns

TO THE EDITORS:

In a recent issue of THE FOUNDRY reference was made to a method of cleaning and maintaining metal patterns in a condition that would prevent sand from sticking to them. The following method is used by the Brown & Sharpe Mfg. Co., Providence, R. I., in treating their cast-iron patterns: The surface of the pattern is cleaned thoroughly, to remove all traces of oil and grease. Sandpaper may be used for this purpose.

After the metal surface is clean it either is dipped in water or rubbed with a clean cloth or sponge saturated with water and allowed to rust. The water should be applied evenly and should not collect in pools on the pattern as the rusting must take place evenly over the surface. It then is allowed to dry and the operation repeated until a deep, even rust coats the surface of the pattern. Wax is applied to the pattern which is heated sufficiently to allow the wax to flow. Either a cloth or a brush is used to coat the pattern with wax. When the pattern is cool, not cold, it is polished with a cloth. In preparing the wax we use ½ pint of bayberry tallow, one tablespoon of quick drying japan or lacquer and ½ teaspoon of black lead. This mixture is heated and mixed thoroughly before being applied to the pattern.

WILLIAM L. BARBER,

Chief Patternmaker,
Brown & Sharpe Mfg. Co.,
Providence, R. I.

A. J. Miller Jr., sales representative, Whitehead Bros. Co., Providence, R. I., has been transferred from the New York district to New England district.

The Shakeout

DAN M. AVEY, Editor
PAT DWYER, Engineering Editor
EDWIN BREMER, Metallurgical Editor
FRANK G. STEINEBACH, Managing Editor
CHARLES VICKERS, Nonferrous Editor
NORMAN F. HINDLE, Assistant Editor

¶ Good Work Goes

DEVELOPMENT and standardization of foundry sand testing methods by the American Foundrymen's association ranks first in the progressive steps of the foundry industry and is a symbol of what may be accomplished by proper co-operation. The committee on molding sand research has been working on sand tests for eight years and for the past four years complete sand testing methods have been available to foundrymen for testing and controlling molding sand in the foundry and in the sand pit. Over 300 foundries in the United States and many in foreign countries are controlling molding sand by American Foundrymen's association test methods.

USE of fineness and clay determination tests enable foundrymen to determine the exact percentage of clay bond in foundry sands and the coarseness of the grains of which the sand is composed. The American Foundrymen's association sand rammer and permeability apparatus gave to the foundryman a practical method of determining the venting quality of any given sand. Bond strength of a sand is measured by the so called compression test. Other tentative recommended strength tests are cohesiveness, shear and tensile. Any one of these tests, may be used for control work. For research work or specifications, the compression test is essential. Tentative standard methods of grading foundry sands will enable each sand producer to classify his various sands according to a standard grading number. For example, a 2F sand would contain 10 to 15 per cent of clay bond and a No. 2 grain size.

TENTATIVE standards for tensile and transverse bar tests have been established for testing the strength of cores. Standard mixing methods, making test specimens, baking test specimens and standard method of breaking test bars, are other items under consideration. A large amount of comparative investigation work now is under way to determine the proper standard methods of testing a core. The permeability test is nearly complete. A hardness test also is under consideration. Subcommittees are working on rebonding clays, conservation and reclamation, investigation of spent sand in steel foundries, durability and testing apparatus. Extent of molding sand research work carried on by the American Foundrymen's association may be inferred from the fact that over 70 active members are directly interested in carrying on this work.

¶Preaching and Believing

ENTHUSIAM for a subject often leads to a line of reasoning which is far from consistent. This situation has developed in connection with the campaign being waged by certain interests to further the use of variously fabricated rolled metals to the detriment of castings. Many claims which seem rather inconsistent are being made by those interests.

FOR example, a recent issue of a business paper carries an advertisement of a company manufacturing punching and shearing machinery. A greater portion of the page is devoted to the fictitious lamentation of a supposed salesman of castings because one of his customers had redesigned its line and now was using pressed metal parts instead of castings. The advertisement states further that firms are replacing castings with pressed metal parts because the latter are economical, weigh less, require less fitting in assembly, can be attractively finished and are less bulky.

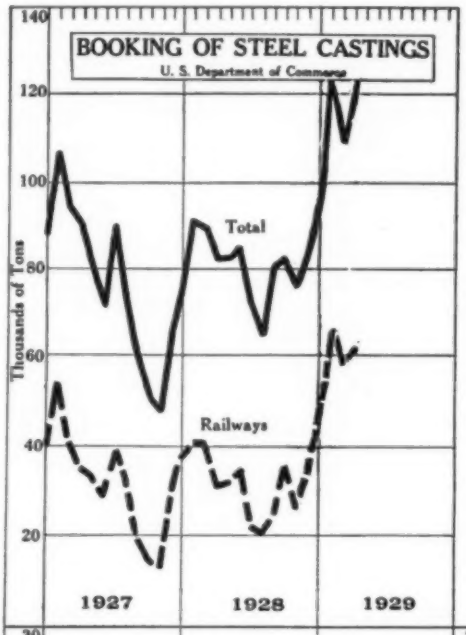
AT THE bottom of the page is shown one of the line of power presses made by the company sponsoring the advertisement and strange as it may seem, the greater portion of that machine is constructed of castings. Surely the manufacturer of machinery would want to use an economical material, one that could be assembled easily and thus reduce production costs and one that would require a minimum amount of room. Evidently the manufacturer of this equipment is not completely sold on statements made in his advertising regarding castings versus stampings.

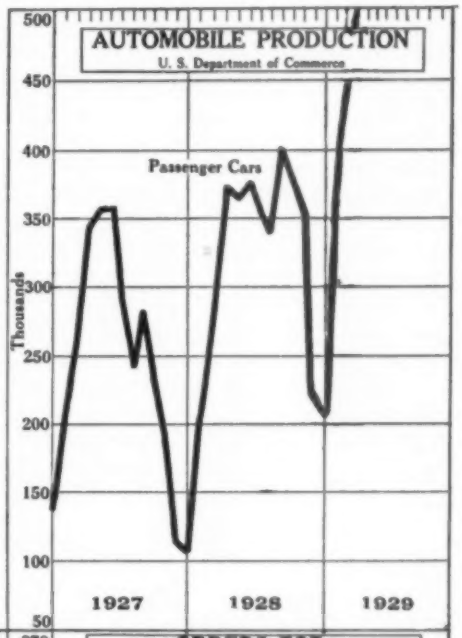
Trade Trends in Tabloid

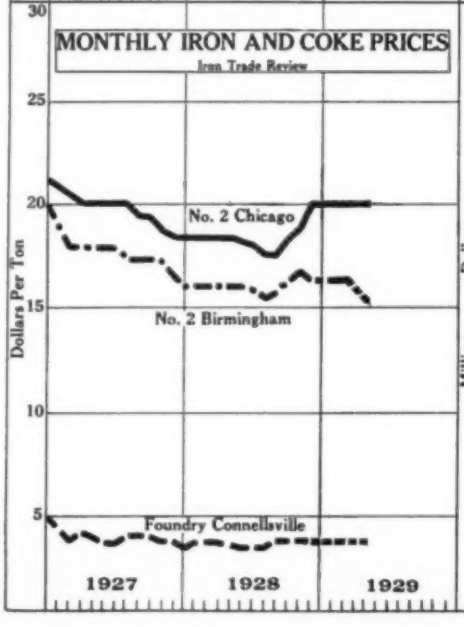
FOUNDRY operations continue at a high rate in keepng with record breaking production schedules in many lines of American industry. Automobile production in April established a new high record for all time with a total output of 538,679 passenger cars in the United States. Preliminary reports indicate that a high production rate was maintained in May, with an expanded foreign demand aiding American car builders. Freight car loadings for the week ended May 4 were well above the million mark, although a slight loss was noted over the preceding week. Building awards in 37 states east of the Rockies totaled $642,064,500 in April, an increase of 32 per cent over March. New building construction work contracted was the highest total recorded since June, 1928. Demands from jobbing foundries are good, with little indication of a slackening in the near future. Malleable operations are highly satisfactory, although slight recessions are noted here and there. Ohio Foundries Association, Inc., reports April operations at 113.1 per cent of normal compared with 108.8 per cent in March. Shipments of pig iron are heavy, although buying for third quarter continues light. A number of foundries making automobile castings have purchased iron considerably in excess of second quarter contracts. Nonferrous foundries are operating satisfactorily and shipments of metal are heavy.

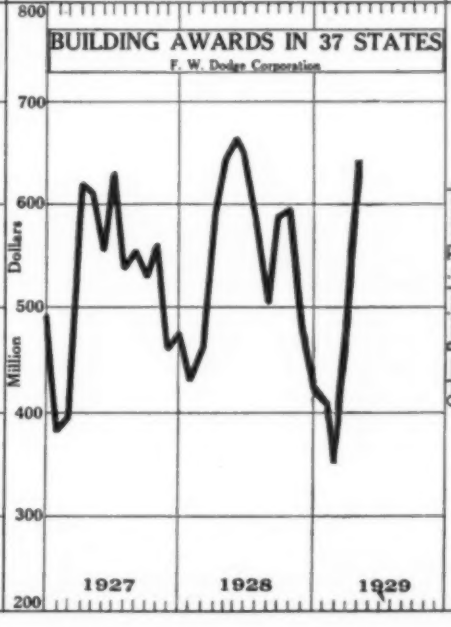
RAW MATERIAL PRICES
May 20, 1929

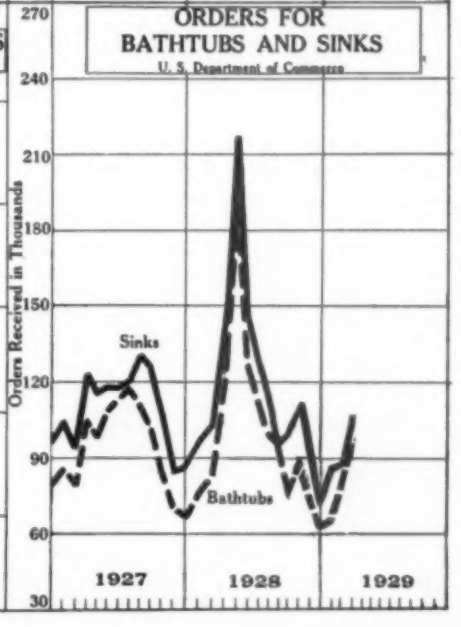
Iron	
No. 2 foundry, Valley	$18.50
No. 2 southern, Birmingham	15.00 to 15.50
No. 2 foundry, Chicago	20.00
No. 2 foundry, Philadelphia	22.26
No. 2 foundry, Buffalo	19.50
Basic, Valley	18.50
Basic, Buffalo	17.50
Malleable, Chicago	20.00
Malleable, Buffalo	20.00
Coke	
Connellsville foundry coke	$3.75 to 4.85
Wise county foundry coke	4.25 to 5.00
Scrap	
Heavy melting steel, Valley	$17.50 to 18.00
Heavy melting steel, Pitts	17.25 to 18.25
Heavy melting steel, Chicago	15.50 to 16.00
Stove plate Buffalo	13.00 to 13.25
Stove plate, Chicago	12.75 to 13.25
No. 1 cast, New York	13.00 to 13.50
No. 1 cast, Chicago	15.50 to 16.00
No. 1 cast, Philadelphia	16.00 to 17.00
No. 1 cast, Pittsburgh	15.00 to 16.00
No. 1 cast, Birmingham	13.00 to 14.00
Car wheels, iron, Pittsburgh	16.00 to 16.50
Car wheels, iron, Chicago	14.50 to 15.00
Railroad malleable, Chicago	18.50 to 19.00
Agricultural mal., Chicago	16.00 to 16.50
Malleable, Buffalo	19.00 to 19.50
Nonferrous Metals	Cents per pound
Casting, copper, refinery	17.50
Electro, copper, producers	18.00
Straits tin	44.00
Lead, New York	7.00
Antimony, New York	8.87½
Nickel, electro	35.00
Aluminum, No. 12, producers	23.00
Aluminum, No. 12, remelt	17.00 to 17.50
Zinc, East St. Louis, Ill.	6.60 to 6.65











Personal

A. Damour, president of Societe des Fonderies de Bayard et Saint-Dizier, vice president of Societe Anonyme des Hauts Fourneaux, Forges et Acieries du Saut-du-Tann, managing director of Societe des Hauts Fourneaux de Maxeville and a director of many other companies, has been elected president of the Association Technique de Fonderie de Paris. He took office on April 18. Leon Thomas, president of the association from 1927 to 1929, was unanimously elected president of honor.

S. C. Watkins, formerly special representative of the Southern Wheel Co., New York, has been elected vice president of that company. His headquarters are at 818 Munsey building, Washington. S. F. Pryor Jr., representative of the company, also was elected vice president and H. S. Russell was appointed district sales manager at 1414 McCormick building, Chicago.

H. W. Gillett, chief of division of metallurgy, bureau of standards, Washington, has been appointed director of the Battelle institute, Columbus, O., which was founded by Gordon Battelle and Mrs. J. G. Battelle in memory of J. G. Battelle, and intended to be a research institution for contact between science and industry.

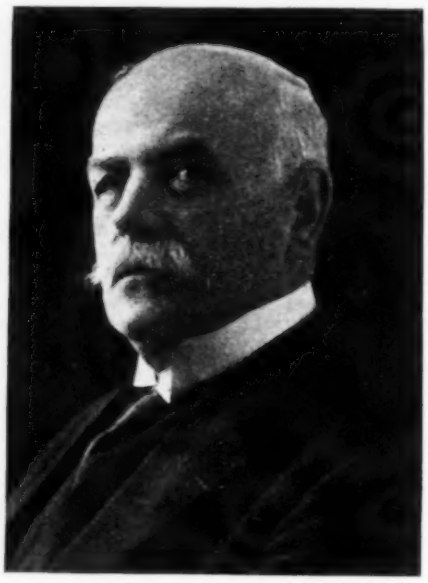
Harry Cockshutt, president of the Cockshutt Plow Co., Brantford, Ont., has been elected chancellor of the University of Western Ontario, London, Ont.

A.S.T.M. Meets in June

(*Concluded from Page* 473)

Under Stress," by D. J. McAdam Jr., and "Influence of Corrosion Accelerators and Inhibitors on Fatigue of Ferrous Metals," by F. N. Speller, I. B. McCorkle, and P. F. Mumma.

Nonferrous metals, general, will be the topic for discussion on June 27 at 8 p.m. Reports of committees to be presented are those on high temperature and electrical resistance alloys, Dean Harvey, chairman; nonferrous metals and alloys, William Campbell, chairman; and light metals and alloys, cast and wrought, J. B. Johnson, chairman. Papers of interest to foundrymen will be "Fatigue Data on Some Aluminum Alloys," by J. B. Johnson and T. T. Oberg, and "Aluminum Alloys for Pressure Die Castings," by Sam Tour. On Friday, morning a session on nonferrous metals will be held. This session will be devoted to a discussion of nonferrous metals, copper and copper alloys, and metallography. Two committee reports to be presented are those on metallography, H. C. Boynton, chairman, and copper and copper alloys, cast and wrought, C. H. Mathewson, chairman. Papers to be presented will deal with tests of sheet metals and drawing copper, "Hardness Relationships and Physical Properties of Some Copper Alloys," by C. H. Davis and E. L. Munson, and



A. DAMOUR

"Bearing Bronzes With and Without Zinc," by H. J. French and E. M. Staples.

Names Works Manager for Philadelphia

Neil Currie, Jr., formerly managing engineer of the motor department, Pittsfield, Mass., works of the General Electric Co., for the past 5 years, has been named manager of the Philadelphia works. Mr. Currie is a graduate of the University of Minnesota and entered the employ of the General Electric Co. in 1908 when that company purchased the power apparatus department of the Western Electric Co., Chicago. Robert V. Good, formerly section superintendent in the Schenectady works of the General Electric Co., Schenectady, N. Y., has been named assistant to the works manager. Mr. Good is a native of Germany and entered the employ of the company in 1913. He has been a section superintendent at the Schenectady works since Jan. 1, 1928.

David D. Lupton, formerly senior vice president of David Lupton's Sons Co., Philadelphia, has been elected president of the company. He succeeds Edward Lupton, recently deceased.

Obituary

Edward F. Carry, 61 years old, president of the Pullman Co., Chicago, and West Pullman, Ill., and a director and official in numerous other companies, including Pullman Inc., recently died suddenly. Mr. Carry was a native of Fort Wayne, Ind., son of a foundryman and started as a stenographer in 1888 for the Wells & French Co., Chicago, railroad car builders. In 1899 he went with the American Car & Foundry Co., becoming vice president in 1915. A year later he joined the firm of Haskell & Barker Co., Michigan City, Ind., as its president. When the company was absorbed by the Pullman Co. in 1922, Mr. Carry was elected president of the Pullman company. During the war years Mr. Carry was chairman of the shipbuilding adjustment board and director of operations of the United States shipping board from September, 1917, to October, 1918. He also was trustee of the Emergency Fleet Corp. and was chairman of the port and harbors facilities commission under the shipping board. Mr. Carry was a member of many organizations, including the American Iron and Steel institute. He also was a member of many clubs and civic organizations.

G. Albert Carpenter, for more than 40 years owner and manager of the Albert Carpenter Machine Co., Muncie, Ind., died April 30 from heart disease. He started in the machine tool business at the Muncie Foundry & Machine Co., Muncie, Ind., and in 1896 established his own company in which he took an active interest until his death.

J. F. McClure, 47, New York representative of the Alabama Pipe & Foundry Co., Anniston, Ala., and the Lynchburg Foundry Co., Lynchburg, Va., died May 4 at Santa Fe, Mexico. He had been identified with the cast iron pipe industry for approximately 35 years.

Frank Ticknor, president of the Shenango Penn Mold Co., Sharpsville, Pa., died at his home in Sharon, May 1, after two days illness with pneumonia. He returned to the Shenango valley two years ago after being in business in Chicago for some time.

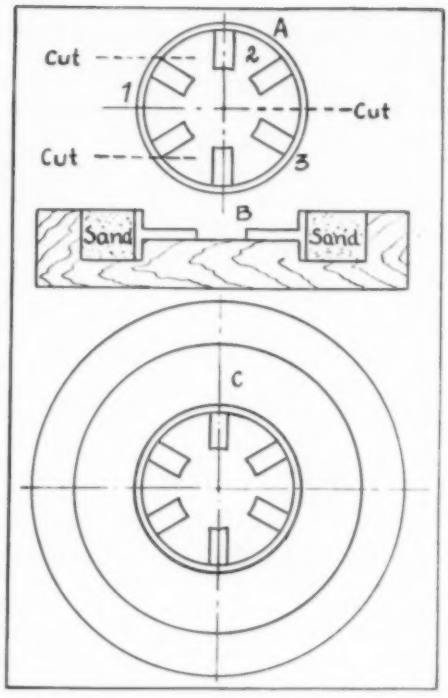
Henry A. Ross, president of the Ross-Tacony Crucible Co., Philadelphia, died May 10 at his home in Philadelphia. He was 53 years of age. Mr. Ross became president of the company at the death of his father in 1898.

Core Forms Figures on Rim of Casting

By F. Leu

A large prospective order for brass counter wheels with sunken figures on the rim resulted in the development of an ingenious and satisfactory method for making these castings. These wheels were about 2 inches in diameter with a ½-inch face on which the figures were recessed. Originally these figures had been cut on the blanks either by engraving or with acid and the proposal to cast the wheels with the figures in place promised a substantial saving—if it could be done satisfactorily. In its general features the wheel resembled a small pulley with a hub in the center connected to the thin rim by six arms.

The method adopted was the same as that usually employed in making small sheaves. The outside of the mold containing the projecting bodies of sand designed to form the character on the face of the wheel, was made in a dry sand ring core. A set of patterns was made with ring core prints around the circumference corresponding to the size and shape of the ring cores. The inside of each pattern, the hub and arms was made in the usual manner.



THE BRASS CASTING WAS CUT AT *A* AND MOUNTED IN THE WOOD COREBOX AT *B* AND *C*

A wood corebox was made, as shown in the accompanying illustration, B and C. One finished brass wheel supplied by the customer and with the figures carefully cut on the face, was utilized as part of the corebox. It was cut apart in three places as shown and then reassembled and mounted in the center of the wood corebox. Sand was rammed in the space between the brass and wood. The corebox was rolled over and removed. The brass sections then were drawn away horizontally one at a time in the order shown, 1, 2, 3.

Motor Is Fan Cooled

Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa., recently has introduced a new, totally enclosed, fan cooled motor for direct current applications. All mechanical parts, with the exception of the shaft, are interchangeable with enclosed motors of the same type and frame size made by the company. The mounting dimensions of the new type motor are the same as on the standard motor of the same type and frame size.

The cooling system does not interfere with the effectiveness of the motor enclosure. The bracket openings are closed with solid, flat, enclosing

Foundry Association Directory

American Foundrymen's Association

President, S. T. JOHNSTON, S. Obermayer Co., Chicago; secretary-treasurer, C. E. HOYT, 222 West Adams street, Chicago; technical secretary, R. E. KENNEDY, 222 West Adams street, Chicago.

Associated Brass Founders of New England

President, J. A. DUNCAN, Wm. Duncan & Sons Co., 166 Liverpool street, East Boston, Mass. Meeting the fourth Wednesday of each month at the Engineers' club, Boston.

The Buffalo Foundrymen

President, J McARTHUR, Washington Iron Works; secretary, W. J. WARK, E. J. Woodison Co., 140 Chandler street. Meetings each month at club rooms, 140 Chandler street.

Central Illinois Foundrymen's Club

President, H. M. HIRE, Hire Foundry Co., Peoria, Ill.; secretary, FRANKLIN WHITEHEAD, The Meadows Mfg. Co., Bloomington, Ill.

Chicago Foundrymen's Club

President, DAVID G. ANDERSON, Western Electric Co.; secretary, ALBERT N. WALLIN, S. Obermayer Co. 2563 W. Eighteenth street. Meetings first Thursday in each month at the City club, 315 Plymouth court.

Connecticut Foundrymen's Association

President, FRED W. STICKLE, 25 Woodrow street, West Hartford, Conn.; secretary, C. S. NEUMANN, Union Mfg. Co., New Britain, Conn. Meetings are on second Friday of each month in various parts of the state.

Detroit Foundrymen's Association

President RUSSELL M. SCOTT, Packard Motor Co., Detroit; secretary, WILLIAM J. MUHLITNER, Great Lakes Foundry Sand Co., Detroit. Meetings third Thursday in each month at appointed place.

East Bay Foundrymen's Association

Secretary O. R. MOLLER, Electric Steel Foundry Co. Inc., 1328 Second street, Berkeley, Calif.

Gray Iron Institute

President, WALTER L. SEELBACH, Forest City-Walworth Run Foundries Co., Cleveland; Secretary, ARTHUR J. TUSCANY, Terminal Tower building, Cleveland.

Malleable Iron Research Institute

President, R. R. FAUNTLEROY, Moline Malleable Iron Co., St. Charles, Ill.; secretary ROBERT E. BELT, Union Trust building, Cleveland.

Metrolpolitan Brass Founders' Association

President WILLIAM EMBER, Jefferson Brass Foundry, 62 Delevan street, Brooklyn N. Y.; secretary, WILLIAM E. PAULSON, Thomas Paulson & Son Inc., 97 Second avenue, Brooklyn, N. Y. Meeting second Wednesday in each month at the Building Trades club, 2 Park avenue, New York.

Newark Foundrymen's Association

President, J. L. CARTER, Sachs-Barlow Foundries, Inc., Newark; secretary W. H. MANTZ, Atlas Foundry Co., Irvington, N. J. Meeting called by president.

New England Foundrymen's Association

President CARL S. NEUMANN, Union Mfg. Co., New Britain, Conn.; secretary, FRED F. STOCKWELL, 205 Broadway, Cambridgeport, Mass. Meetings second Wednesday of each month at the Exchange club, Boston. Outings usually are held in the summer months.

Ohio Foundries Association Inc.

President, C. C. SMITH, Toledo Steel Casting Co., Bancroft and Smead avenue, Toledo, O.; secretary-manager, E. F. SCOTT, 418 Penton building, Cleveland.

Philadelphia Foundrymen's Association

President, WALTER WOOD, R. D. Wood & Co., Philadelphia; secretary EARL SPARKS, 1623 Sansom street, Philadelphia. Meetings the second Wednesday of each month at the Manufacturers' club.

Southern Metal Trades Association

President, GEORGE B. COCKER, Gastonia, N. C.; secretary, W. E. DUNN JR., Healy building, Atlanta, Ga.

Pittsburgh Foundrymen's Association

President, L. W. MESTA, Mesta Machine Co., Homestead, Pa.; secretary-treasurer WILLIAM J. BRANT, Wm. J. Brant, Bessemer building, Pittsburgh. Meeting on the third Monday of the month, except in July and August, at Fort Pitt hotel.

Quad-City Foundrymen's Association

President, F. W. KIRBY, John Deere Spreader Works, East Moline, Ill.; secretary-treasurer, J. P. BOADEN, Union Malleable Iron Co., East Moline, Ill. Meetings the third Monday of each month, the meeting place being rotated between Moline, Rock Island and Davenport.

Steel Founders' Society of America

President, J. E. MCCAULEY, Birdsboro Steel Foundry & Machine Co., Birdsboro, Pa.; managing director, G. P. ROGERS, Graybar building, New York.

Tri-City Technical Council

Chairman F. V. SKELLEY, Tri-City Railway Co., Rock Island, Ill.; treasurer, MAX SKLOVSKY. Deere & Co., Moline, Ill. Combined meetings held only one or two times a year on call.

Tri-State Foundrymen's Association

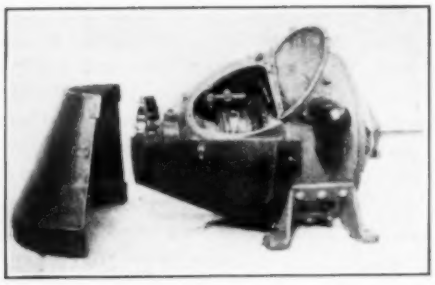
President, WILLIAM HOPPENJANZ, The Star Foundry Co., 221 Main avenue, Covington, Ky.; secretary, GEORGE W. PIEHL, Wesaling Bros. Foundry Co., 1607 McLean avenue. Meetings the second Thursday of each month at the Cincinnati club, Eighth and Race streets.

Twin City Foundrymen's Association

President, WILLIAM E. LOBERG, American Hoist & Derrick Co., St. Paul; secretary-treasurer, C. E. LANGDON, 3849 Lyndale avenue, south, Minneapolis. Meeting third Wednesday of each month at Athletic club.

Washington Foundrymen's Club

President, J. W. ORPHAN, Lake Union Foundry Co., 1703 Westlake avenue, Seattle; secretary, EDWARD C. GUSTIN, The Prescott Co., 1 West Lander street, Seattle. Meetings second and fourth Tuesdays of each month at the Elks Temple, Fourth avenue and Spring street.



THE COMMUTATOR END OF THE MOTOR IS ENCLOSED WITH A SHEET STEEL COVER

covers and gaskets. Sealed sleeve bearings are used, totally enclosing the motor and sealing it from dust and fumes.

The commutator end is enclosed further with a sheet steel cover which has a perforated protective end through which the fan draws the cooling air. The air is directed over the bracket and passes out over the top of the motor covering approximately three-fourths of the surface.

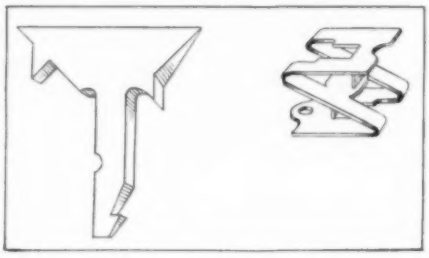
Makes New Type Cranes

Link-Belt Co., Chicago, now is manufacturing a line of locomotive cranes designed for gasoline engine, diesel engine or electric motor drive. The machinery is designed especially for direct engine or motor drive. All clutches, brakes, shafts, bearings, gears, etc., are oversize. The drive from the engine or motor is of the totally-enclosed, silent chain type. All upper frame gears have teeth machined from solid blanks. This line is supplied with a two-speed travel gear to give a high travel speed for traveling light and a slower speed for pulling heavy loads or ascending grades. The travel gear does not have any effect on the other speeds of the machine.

Chaplet Section Is Thin

Reeder Mfg. Co., 6319 Manchester avenue, St. Louis, recently has introduced a new type chaplet, shown in the accompanying illustration. The chaplets are thin in section but strong. It is claimed that they will fuse with gray iron and steel. Due to their open construction, they do not obstruct the flow of metal nor impair the strength of the casting. They are manufactured to given dimensions but these may be changed by compressing them in a vise to fit the necessary requirements.

That company also manufactures a brass chill rib or cracking strip, one of which is shown at the left in the accompanying illustration. These are made in several sizes and types. One type is made for metal pattern and metal core box equipment and the other types are used for the same equipment made from wood. For installing the first type chill rib mentioned in a metal core box a 3/16-inch hole is drilled and the chill is driven into place. Those made for wooden equipment are driven into place with a hammer. It is claimed that that type chill rib is easily installed and at a low cost. The ribs have smooth,



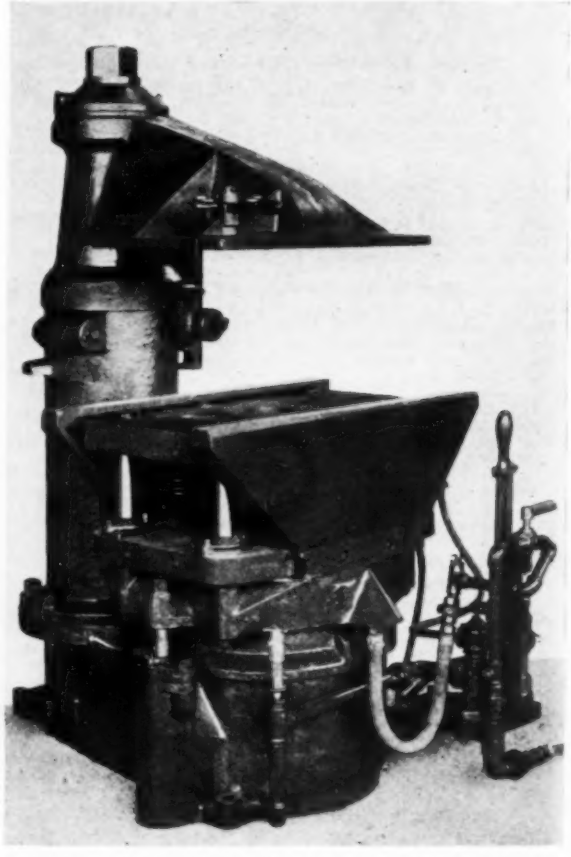
NEW TYPE CHAPLETS AND BRASS CHILL RIBS ARE MADE IN SEVERAL SIZES

drafted finish which allows clean cut molds and cores and when in place aid in securing leather fillets in position. The hooked and notched stem holds the rib firmly in place. Ease of installation eliminates loss of a molder's time in sawing ribs in cores and molds.

Introduces a New Type Molding Machine

Tabor Mfg. Co., 6225 Tacony street, Philadelphia, recently introduced its new type shockless, jarring, squeezing, flask lift molding machine. It is equipped with an 18-inch squeezing cylinder and a 4½-inch draw cylinder. It is designed to take pattern plates 14, 16, 18 or 20 inches wide and as long as 36 inches, the pattern plate support being 14 inches wide. The head of the machine is adjustable for the previously mentioned sizes, and may be furnished with flask lifting sides as shown in the illustration or with adjustable lifting posts. Distance between the pattern plate and the yoke is optional. The height of the machine from the floor to the pattern plate is 32 inches and the total height is 56 inches. The distance between the pattern plate and yoke is 12¼ inches. The yoke is controlled by a lever on either the right-hand or left-hand side depending upon the location of the valve stand. That lever automatically locks the yoke in the front squeezing position or in the back pattern draw position and is spring operated. The yoke is mounted on two taper thrust bearings made by the Timken Roller Bearing Co., Canton, O. The guide rods are sand proof, the draw is oil controlled, the squeezing and pattern draw are controlled by one lever which is provided with a latch to hold the flask after drawing the pattern. Full 14-inch guide is provided throughout the entire travel of the pattern draw.

Air consumption at 80 pounds pressure is 13 cubic feet. The total net weight of the machine is 3400 pounds. Jarring and drawing capacity is 600 pounds with 80 pounds air pressure available.



SQUEEZING AND PATTERN DRAWING ARE CONTROLLED BY A SINGLE LEVER

Designs New Cam Switch

General Electric Co., Schenectady, N. Y., has introduced a new direct-current cam switch for central stations to control auxiliaries such as pumps, blowers, etc. The switch may be used for similar nonreversing applications where the current inrush or starting torque is not severe or the operations are not frequent.

The new switch is available in two forms. Both are for nonreversing

service with armature regulation over five points and one has field regulation over 22 points. The intermittent armature current capacity is 1000 amperes while the same capacity, continuous rating, is 500 amperes. The switches are rated at a maximum of 550 volts.

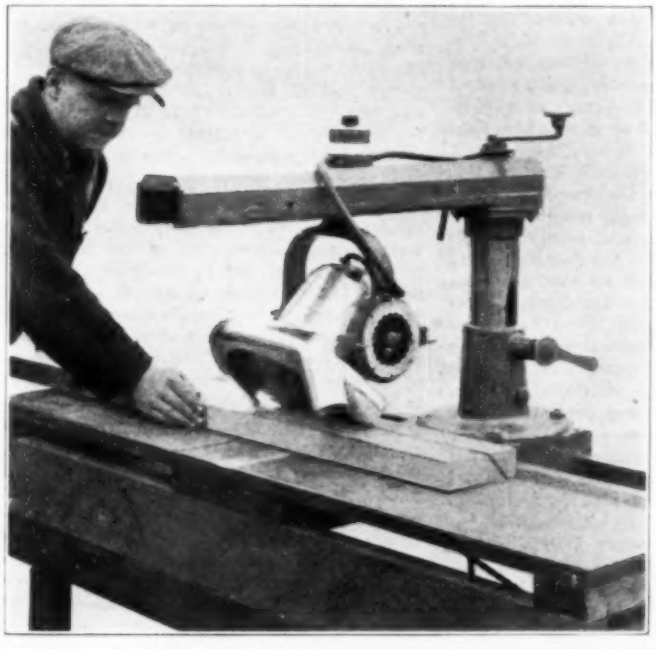
Introduces Welding Rod

A new high strength bronze welding rod recently has been placed on the market by the Oxweld-Acetylene Co., 30 East Forty-second street, New York. This rod is designed for bronze welding applications including the fusion welding of brass and bronze, bronze-welding of malleable and gray iron castings, building up bearings, etc. It is claimed that the composition has a uniformly low melting point, that the flow of metal is controlled easily and that the properties of the rod eliminate to a large extent boiling and fuming of the metal.

Machine Performs Many Operations in Wood

The DeWalt Products Corp., Leola, Pa., recently introduced a new electric woodworking machine designed to perform 29 distinct cutting operations including dadoing, routing, mitering, shaping, grooving, ploughing, rabbeting, mortising, etc. The unit is provided with balanced, guided power applied to the saw in all cutting positions. The machine may be changed quickly from cross-cutting to ripping without stopping the motor. It is provided with accurate ripping gage and valves for adjustment to any position. The universal motor operates on either alternating current or direct current.

The various cutting operations may be performed by attaching the proper cutting tool. All work is handled from one side of the table whether cross-cutting, ripping or shaping and the layout marks always are in plain view. The standard equipment includes an adjustable guard which extends to the work. When fitted on a wooden table 29 x 59 inches, the machine complete weighs 235 pounds.



VARIOUS CUTTING OPERATIONS MAY BE ACCOMPLISHED BY CHANGING THE POSITION OF THE HEAD AND USING THE PROPER CUTTING TOOL

Builds Limit Switch

The General Electric Co., Schenectady, N. Y., has introduced a new line of cam-operated, double-break, master and limit switches for application on such units as skip hoists, car bumpers and other machines requiring geared type switches.

The limit switches may be adjusted by shifting, tripping and closing dogs on the cams. The contact mechanism is of the snap-action type and is latched in both the open and closed positions. The limit switches are available in three forms, namely one-point, three-point and four-point.

Control Pouring Device Electrically

Modern Pouring Device Co., Port Washington, Wis., has introduced an electrically controlled pouring device for molten metals. The device is designed to enable one man to pour quantities of metal up to 1000 pounds. Ladles are raised and lowered by a push button control switch located on the steadying lever. The device is equipped with positive upper and lower limit switches and a throw over switch for reversible control. The steel construction makes the machine compact and light in weight. The entire machine rotates on a ball bearing thrust collar in the frame of the trolley. All moving parts are equipped with roller bearings made by the Timken Roller Bearing Co., Canton, O., run in an oil bath and are protected by dust proof housing. The swivel arrangement is continuous.

THE DEVICE IS OF RIGID STEEL CONSTRUCTION

The device is supplied with a ball-bearing trolley adaptable to any size I-beam. The trolley operates at the low speed of 8 feet per minute. Worm-geared ladles with cast steel trunnion guards are standard equipment for capacities of 500 pounds and over.

Gives Equipment Orders

The index of gross orders for foundry equipment in April was 172.6 as compared with 209.4 for March, according to a recent report of the Foundry Equipment Manufacturers association. The index of shipments for April was 220.3 as compared with 197.5 in March. Unfilled orders were 363.4 for April against 414.4 for March. The base is the average monthly shipments for the years 1922-23-24. Comparisons of monthly orders as presented by the association follow:

Month	1926	1927	1928	1929
Jan.	168.2	180.4	132.7	180.5
Feb.	154.9	198.0	123.6	197.0
March	157.3	131.1	138.6	209.4
April	118.2	130.0	107.7	172.6
May	128.5	134.8	335.6	.....
June	133.5	138.4	149.1	.....
July	127.3	89.9	94.8	.....
Aug.	141.2	106.4	278.0	.....
Sept.	114.0	80.4	170.0	.....
Oct.	140.5	98.0	185.0	.....
Nov.	133.4	95.8	197.8	.....
Dec.	181.0	106.8	166.5	.....

What the Foundries Are Doing

Reflecting the Activities of the Gray Iron, Malleable, Steel and Brass Shops

Standard Foundry & Mfg. Co., De Kalb, Ill., has been dissolved.

John Staples, Mt. Vernon, Ind., plans to construct a 2-story addition to his foundry.

Milwaukee Pattern & Mfg. Co., Milwaukee, has started work on a two-story addition, 45 x 60 feet.

Kazian's Brass Foundry, Seattle, has leased a building on Canal waterway block No. 1 from Port of Seattle.

Kensington Steel Co., South Chicago, Ill., will build a 1-story brick foundry, 30 x 104 feet. The new addition will cost about $8000.

Commonwealth Steel Co., Granite City, Ill., has plans for a 200-foot addition to an existing building and an extension to the core room.

Duriron Co., North Findlay street, Dayton, O., has filed plans for a 1-story addition. The building will cost about $30,000.

Washington Mold, Machine & Foundry Co., West Beau street, Washington, Pa., has awarded contract for constructing a foundry to Hutter Construction Co. (Noted May 15.)

Dominion Wheel & Foundries Ltd., 181 Eastern avenue, Toronto, Ont., is having plans prepared for foundry addition. The cost is estimated at $60,000.

Birdsboro Steel Foundry & Machine Co., Birdsboro, Pa., has been incorporated in Indiana to do business in that state with a capital of $10,000.

Star Foundry Co., 2111 West Spokane street, Seattle, has leased property on Canal waterway block No. 1 from Port of Seattle, where it will build a modern foundry.

Greenfield Lawn Mower Co., Greenfield, Ind., F. J. Murray and R. E. Collins owners, has taken over the Abbott Foundry & Machine shop, Greenfield, Ind., for the manufacture of lawn mowers.

Michigan Gray Iron Foundry, 1024 Tenth street, Marine City, Mich., has been incorporated with $50,000 capital to manufacture and sell metal castings and to do general foundry work, by George Kramer, Marine City.

Francis & Nygren Foundry Co., 2542 Fillmore street, Chicago, W. Francis, president, has awarded contract for plant addition, to Strobel & Hall, 192 North Clark street, Chicago. It is estimated it will cost $60,000.

Minnesota Radiator Corp., Duluth, Minn., has been incorporated to take over the local plant and business of the Minnesota Radiator Co. It will manufacture cast iron radiators for heating purposes. Harry C. Strong, Jr., is secretary and manager.

Seattle-Astoria Iron Works has changed its name to Croyer-Fox Mfg. Co. following recent purchase of the company by the Continental Can Co. This plant specializes in cannery machinery and equipment and is engaged in shipping much of its product to foreign buyers.

State street plant of Howell Foundry Co. Geneva, Ill., was damaged by fire. The loss was estimated at about $15,000.

Niles Tool Works Co., Hamilton, O., has been granted a permit to construct an addition to its foundry, 97 x 144 feet. Work probably will be started immediately.

The purchase of the Commonwealth Steel Co., Granite City, Ill., by the General Steel Castings Corp., is expected to go through. The plan probably will require some financing by the castings corporation. Commonwealth company is capitalized at about $30,000,000 with General Steel Castings at about $15,000,000.

John Hewitt Foundry Co., 17-29 Sherman avenue, East Newark, N. J., has purchased the West Hudson Foundry & Pattern Co. Inc., Kearny, N. J. John Hierwarter, former president of the Kearny company, now is in charge of the nonferrous department of the Hewitt company.

United States Cast Iron Pipe & Foundry Co., Burlington, N. J., manufacturer of cast iron pipe and fittings, has changed its name to United States Pipe & Foundry Co. At the stockholders' meeting recently Charles R. Rauth was elected secretary and treasurer and B. F. Haughton, vice president and treasurer, was elected vice president.

Osgood Co., Marion, O., manufacturer of steam shovels, plans to start immediate construction of an addition to its gray iron foundry, which will increase its capacity 50 per cent.

Racine Steel Castings Co., Racine, Wis., has plans for 1-story addition. A. A. Wickland, 205 West Wacker drive, Chicago, is architect and engineer. That company soon will take bids on a general contract.

New Trade Publications

HEATING EQUIPMENT—Heating equipment for hot galvanizing tanks is described in a recent bulletin issued by the General Electric Co., Schenectady, N. Y. Heating units, method of control and tank protection against leakage are described.

STEEL PLATES—Moltrup Steel Products Co., Beaver Falls, Pa., recently has issued a small pamphlet describing its flat steel plates for core, pattern and bottom plates. The plates may be obtained in any thickness and will be cut to any size or shape.

NICKEL ALLOY STEEL—International Nickel Co. Inc., New York, has brought its buyers' guide to date as of Jan. 1, 1929. The guide covers all items frequently called for and information as to sources of supply for other materials is supplied by the company direct.

AIR FILTERS—Midwest Air Filters, Inc., Bradford, Pa., is circulating a booklet entitled, "Man's Conquest of the Air." It gives an insight into the development of the filtration of air commercially and gives the theoretical consideration and practical application of the equations involved.

ELECTRIC FURNACES—A bulletin by the Ajax Electrothermic Corp., Trenton, N. J., describes its new 3 kilovolt ampere capacity, high frequency electric furnace for melting small quantities of materials. The apparatus occupies about 3.65 square feet of floor space and weighs about 500 pounds.

GRINDING EQUIPMENT—Norton Co., Worcester, Mass., recently has issued a 15-page booklet on high speed snagging equipment. The pamphlet describes two types of grinding wheels and gives the advantages of the floor stand and swing frame grinders made by that company. It is illustrated with views of the different types of grinding machines.

POWDERED FUEL—Combustion Engineering Corp., New York, is distributing a reprint of a paper on powdered fuel in metallurgical work, by W. O. Renkin, which was presented before the World Power Conference in London, in 1928. The paper deals principally with the use of powdered coal in the iron and steel industry, touching on its use in some nonferrous metal work.

CONVEYORS—In a 20-page bulletin of the Mathews Conveyor Co., Ellwood City, Pa., various conveyor systems are described. The publication contains a discussion of conveyor systems and their adaptability to various types of foundries. The bulletin is illustrated by reproductions from photographs of various installations in different types of foundries. Drawings of several installations are included with discussions of the construction features of the types of gravity roller conveyors that the company makes.

APPRENTICE TRAINING—Pettibone-Milliken Co., Chicago, has published a booklet on its student training courses. The booklet tells of the advantages of learning a trade and gives the schedules for the various courses offered. A short story gives a description of the trades that the company has to offer the apprentice. Photographs show views of different departments in the plant.

CRANES—Whiting Corp., Harvey, Ill., has issued a pamphlet describing and illustrating its new type overhead crane. The booklet deals with the details of construction and advantage of that type crane. Reproductions from photographs illustrate the construction features, assembly views and typical installations. Tables of specifications and a list of some of the users of that type crane are included.

ROOFING MATERIALS—New Jersey Zinc Sales Co., 160 Front street, New York, is distributing its recent booklet on nonrusting metal roofing and siding. The booklet gives the advantages of such roofing, and tables give the safe span, safe loads, sizes and the number of square feet of sheets required to cover 100 square feet of area. Its application to steel and wood framed buildings is discussed and the methods of attaching the material under various circumstances is illustrated by drawings.

CONVEYING EQUIPMENT—Richards-Wilcox Mfg. Co., Aurora, Ill., recently has issued a catalog of its conveying equipment. The catalog describes and illustrates its various carrier systems, turntables, cranes, methods of support scales. Different types of buckets and material handling apparatus also are described and illustrated. Specifications and price lists accompany the description of the equipment. A list of the users of the company's equipment is given in the front of the catalog.

DEISEL ENGINES—Chicago Pneumatic Tool Co., 6 East Forty-fourth street, New York, recently has issued a 23-page bulletin on its M. W. M. Benz deisel engines. The bulletin contains a general description of the engine, details of construction. It is illustrated with reproductions from photographs of typical installations, illustrations of the various parts and phantom and working drawings. The feature of the bulletin is the chart showing the cost of fuel at various prices per gallon, for different sized engines operating at different loads.